Design Engineering

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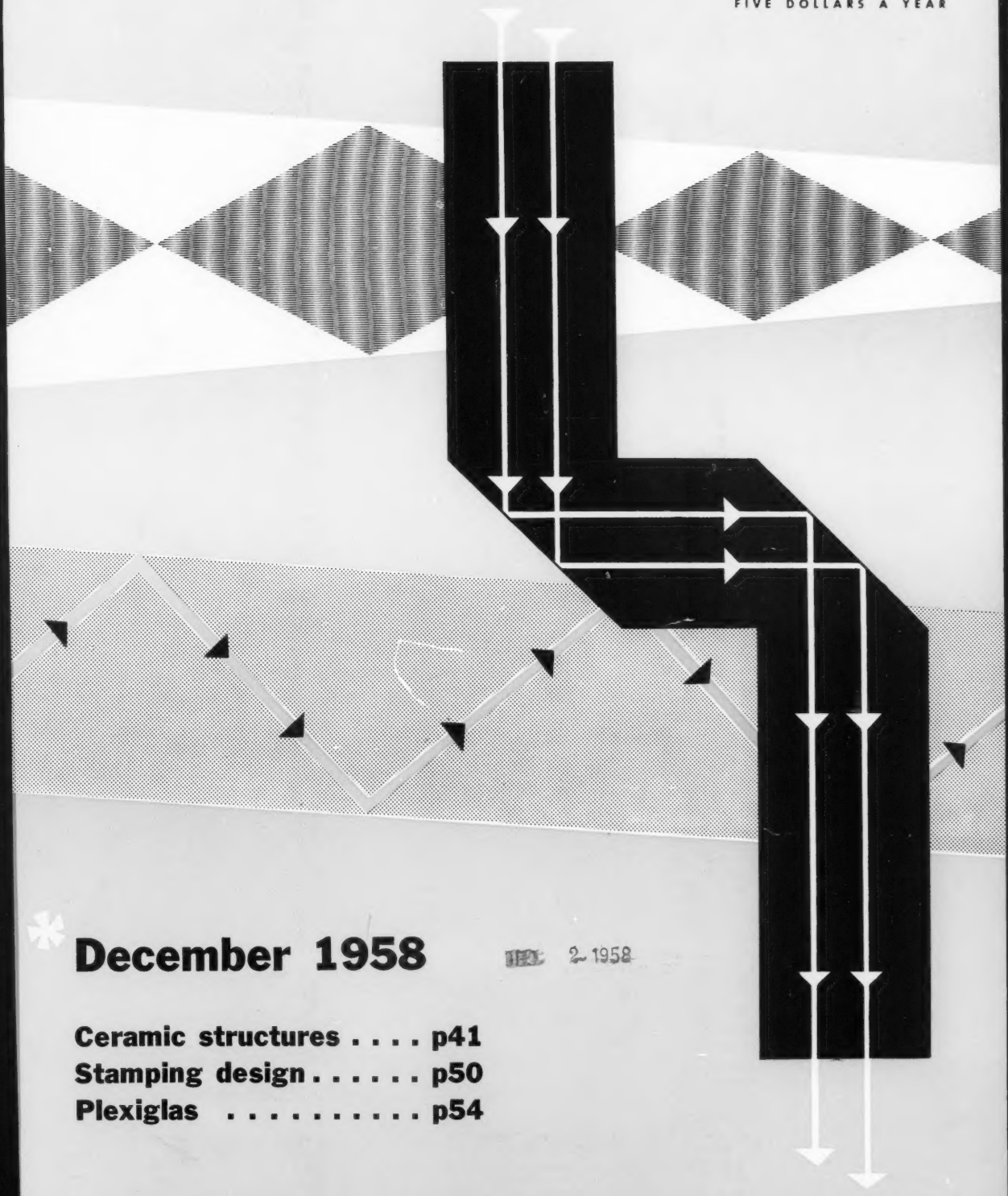

December 1958

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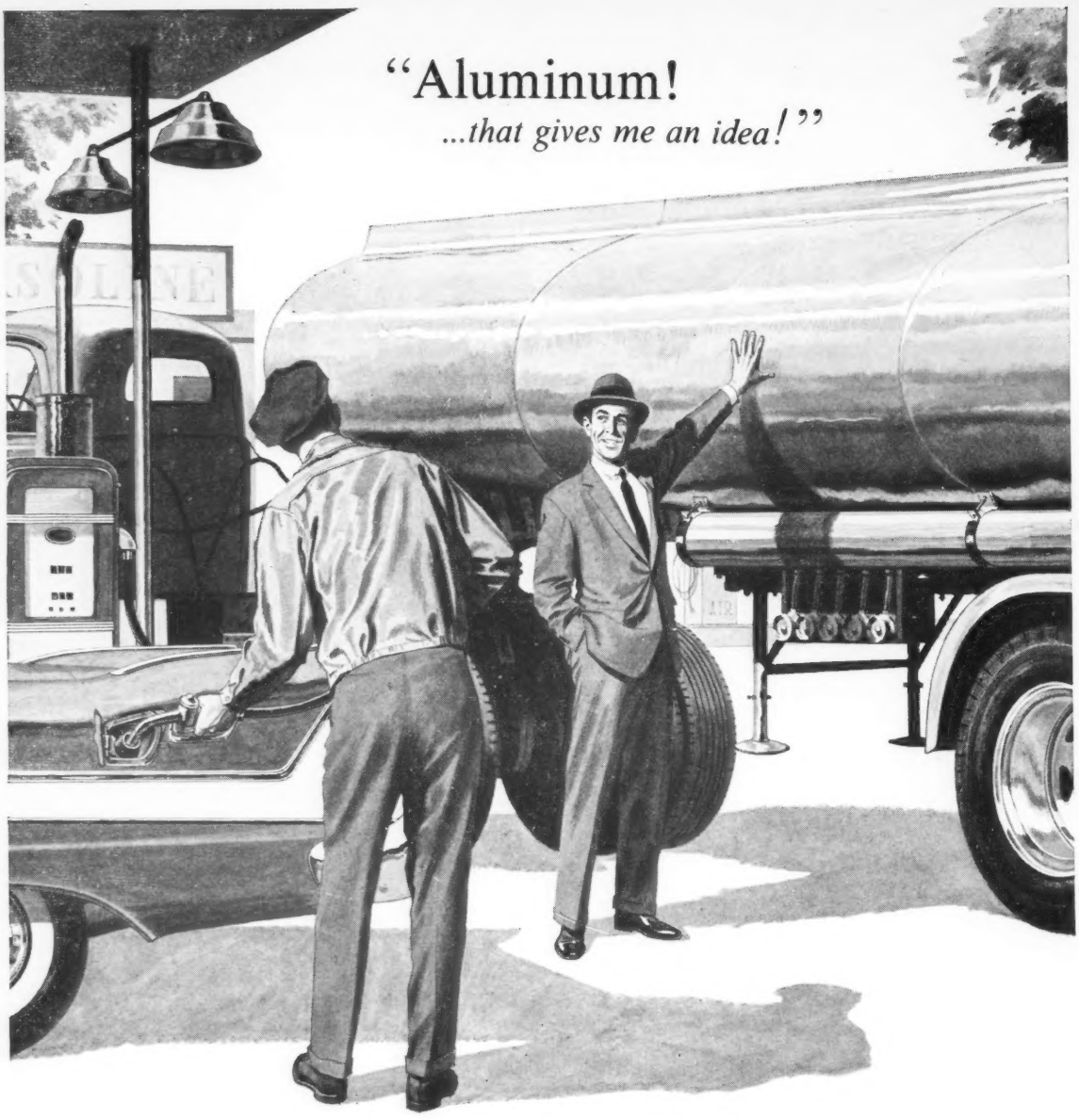
Ceramic structures p41
Stamping design p50
Plexiglas p54

PUBLISHED BY THE MACLEAN-HUNTER PUBLISHING COMPANY LIMITED, TORONTO, CANADA



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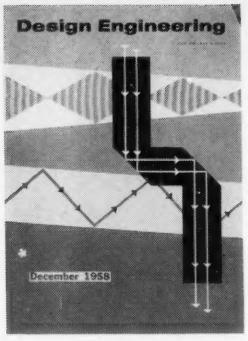

Design Engineering

Vol. 4 **DECEMBER 1958** No. 12

This month's cover

The optical properties of plexiglas is the theme of this month's cover. Strangely enough, it isn't a product of the artist's mind but a simple treatment of the laws of refraction and reflection. This is one time when the subject matter created its own abstraction.

Design Engineering

MEMBER

CCAB

Printed and published by Maclean-Hunter Publishing Company Limited. Editorial and Advertising Offices: 212 King Street West, Toronto 2, Canada. Address all correspondence: **P. O. Box 100, Toronto, Canada.** Horace T. Hunter, Chairman of the Board; Floyd S. Chalmers, President; Donald F. Hunter, Vice-President and Managing Director.

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You get these 6 distinguishing characteristics:

PHYSICAL PROPERTIES

Their high mechanical strength and impact and abrasion resistance are important in tooling applications. These properties are also necessary in offering protection to delicate electronic and electric assemblies.

CHEMICAL AND MOISTURE RESISTANCE

Epoxies resist corrosion and withstand attack from many liquid and gaseous industrial chemicals, oils and greases. Impervious to moisture penetration, epoxies protect sensitive parts, such as coils and armatures.

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Not only do epoxy tooling compounds ensure close tolerances in reproduction but they also maintain this accuracy throughout the life of the tool.

ELECTRIC PROPERTIES

Insulating resistance and dielectric strength are superior. Working life is extended and efficiency is improved when assemblies are protected by epoxy resins.

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Ability of epoxy formulations to bond such materials as ceramics, plastics, and wood enhances the serviceability of these materials in many fields. Property particularly important in coatings where adhesion of finish is equally important as quality of coating.

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Giving more information about "BAKELITE" epoxy resins, and other plastic raw materials.

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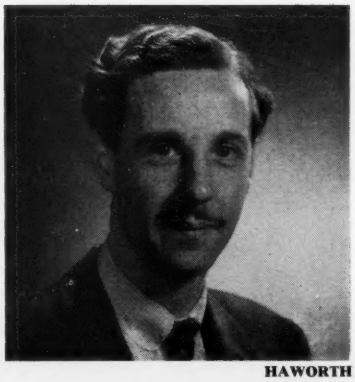
MACLEOD

D. A. MacLeod has been with the Defence Research Chemical Laboratories since Defence Research Board took over Chemical Warfare Lab from the Canadian Army in 1948. He joined the latter in 1942. Mr. MacLeod was born in Scotland and came to Canada in 1919, graduating from Queens University in 1938 with a degree in chemical engineering. Apart from short periods of work with two companies, he has been employed by the Government ever since 1942.

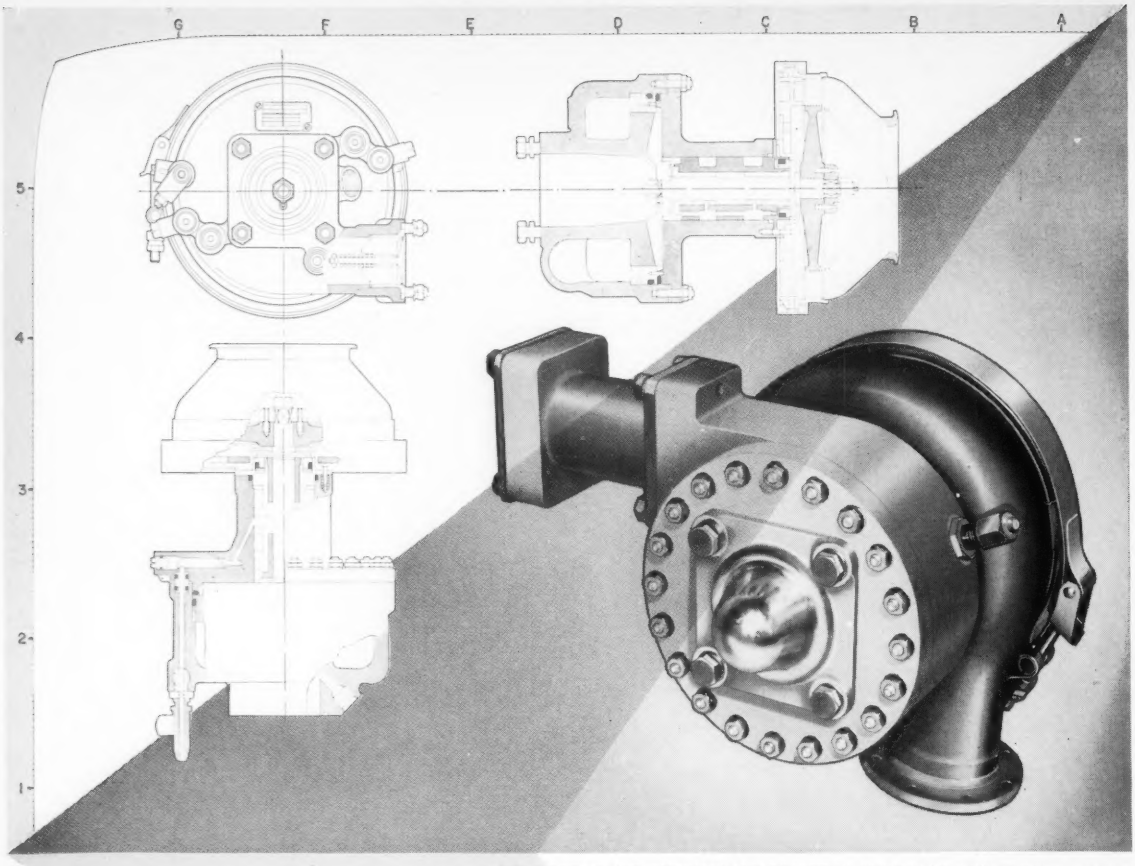
Co-author of the flexibility tester article in this issue is J. A. Wheat who hails from Saskatchewan. He is also on the staff of the Defence Research Chemical Laboratories at Shirley Bay, just outside of Ottawa. Prior to that, he was employed by the Division of Biology, National Research Council. He has a degree in chemical engineering from the University of Saskatchewan and a master's degree from Columbia U.

WHEAT



HAWORTH

Replacing John Dennis as assistant editor of Design Engineering is Eric Haworth. He has acquired a wide background in writing — starting out as a cub reporter on his hometown newspaper in England. Since coming to Canada seven years ago, Haworth has worked as staff writer with agencies and public relations consultants. He has traveled extensively in many parts of the world. Interior and furniture design is one of his hobbies.



LUCAS-ROTAX AIR TURBINE CENTRIFUGAL IMPELLER FUEL PUMP—designed for operation with the more powerful gas turbine engines requiring higher fuel flow.

ADDING THAT VITAL DIMENSION

with LUCAS-ROTAX creative engineering

Complex fuel control systems are being continually developed and improved at Lucas-Rotax—by skilled engineers with more than 25 years of experience in advanced fuel and electrical system design. One such notable development is the Air Turbine Centrifugal Impeller Fuel Pump illustrated.

Lucas-Rotax have engineered a complete range of self-lubricating high pressure and boost pumps for aircraft use providing for flows from 60 g.p.h. to dual installations giving flows in excess of 8,000 g.p.h. Mechanically driven versions are also available. With manufacturing and overhaul plants located in Toronto, Montreal and Vancouver, our facilities for design, development and production are unmatched in Canada. Call on the specialists at Lucas-Rotax for help with your project problems.

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Reports

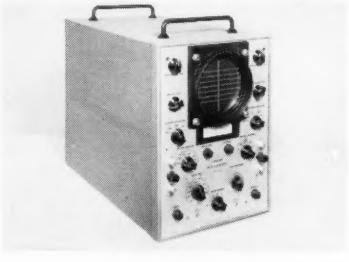
A news roundup of items of engineering and design interest from the world over

Hermetically sealed house for explorers

Moon explorers might live and work in "moon building" like this according to Wonder Building Co. of Chicago, who made it. Built to scale of 1 in. equals 10 ft. building would be 340 ft. long, 160 ft. wide and 65 ft. high. Upper section over structure is a protective shield to ward off rain of interplanetary meteoric dust which descends with great velocity on the barren surface of the moon.

Dome in centre of barrier is traffic control tower and plastic bubble observatory in foreground is protected by sliding metal doors from intense ultra-violet radiation. Dr. J. S. Rinehart (Colorado School of Mines) is technical director of project.

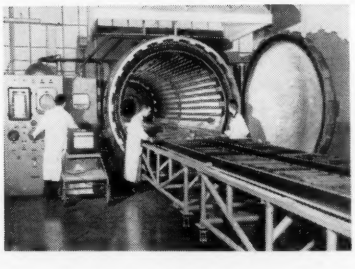
Oscilloscope wins 1958 I.R.E. award



The Institute of Radio Engineers award for the outstanding example of a Canadian electronic product developed during 1958 was presented to the Bach-Simpson Co.

This was for the model 2610 oscilloscope which was completely designed, engineered and produced in the firm's London, Ontario, plant. Wide band deflection systems combined with flat-faced 5-in. cathode ray tube allow observation and photo-recording of continuous and pulse-type wave forms. Other features are the vertical amplifier system, a very effective synchronizing circuit and maximum immunity against line voltage fluctuation. Mr. R. Wilton received the award.

Baking aircraft wings in giant oven



A wing section of the CF-105 Arrow being inserted in high-temperature metal-bonding autoclave. Technician at left sets controls for the completely automatic work cycle. The critical nature of process using phenolic polymer resins requires surgical cleanliness.

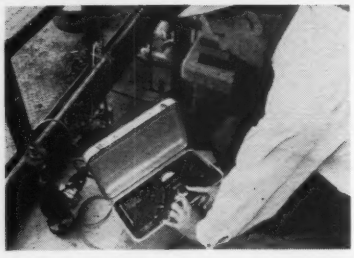
Process of metal bonding is a development of the jet age. Previous method of drilling holes and inserting rivets cannot be used on vital structural members of supersonic aircraft. Now, almost all high speed aircraft are "glued" together. Cylindrical oven shown is 8 ft. wide and 30 ft. long. Steam heating coils and electric element give working temperature of 500 deg. F.

Custom carryall moves 120-ton compressor

Dusty, on-location photograph at left shows a 100-ton capacity carryall at work moving a 120-ton compressor unit. During laying of 2,290-mile natural gas pipeline from Alberta to Quebec, units like this had to be moved from railroad site to station site under "off-road" conditions.

To keep load to reasonable limit, double gooseneck was engineered to enable 34 tires to be used. For lighter loads front gooseneck can be unhooked and rear unit used as conventional machinery float. Pipeline compressor on carryall is 30 ft. long, develops 3,500 hp at 330 rpm. Fruehauf Trailer Co. made carryall expressly for Trans-Canada Pipe Lines Ltd.

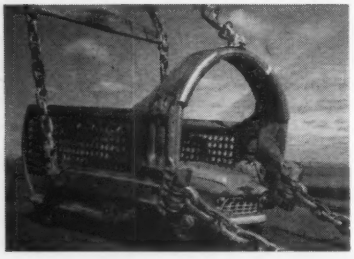
Small box measures internal pipe corrosion



A new electronic measuring technique has been developed that promises to sharply reduce the cost of controlling internal corrosion in process equipment and pipe lines. Capable of detecting a millionth of an inch corrosion, the new technique provides a daily—even hourly—record of corrosion attack.

Special "probes" are used consisting of two elements made from same type of metal used on processing equipment. One is exposed to corrosive environment, other is protected by plastic. As exposed element corrodes, its resistance increases. An instrument measures resistance ratio as compared to protected element. Crest Instruments of Sante Fe Springs, Calif., make equipment.

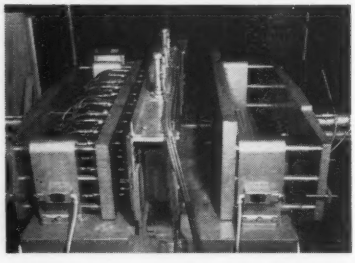
One-ton truck fits in grab-bucket



The largest earth-moving machine ever to operate in Canada is now at work in Saskatchewan's lignite coal fields for Western Dominion Coal Mines. Photograph at left shows the 33-ton bucket of the giant dragline. Swinging from its 220-ft boom, it can chomp up 50 tons of earth at one bite.

The giant dragline itself—nicknamed "Mr. Klimax"—weighs nearly 1,670 tons, runs on electricity and is self-propelled by means of massive steel legs and shoes. Machine's job is to remove overburden from strip mining; cost over $2 million; was built by Marion Power Shovel Co. of Marion, Ohio.

Drills and indexes 408 holes in 30 sec.



A carbon anode drilling machine, designed to drill hundreds of holes in a block of carbon used in atomic energy work has just been fabricated.

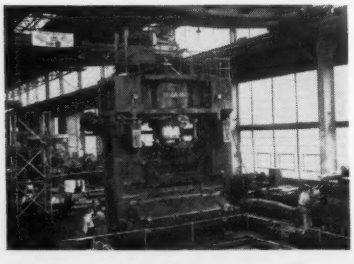
Operating at 12,000 rpm, 99 Keller Tool drills are used in this installation. They drill five series of holes in a common anode, 48x19x5 in. Nearly any pattern or combination of holes can be drilled by a machine using this principle of lateral and vertical indexing. Machine is produced by the special machines section of Gardner-Denver Company, Quincy, Ill.

The "flying cut-away drawing" it's called

The Westland Westminster is claimed to be the largest single rotor turbine-powered transport helicopter yet built in the Western world. Its engines are Napier Elands, each capable of developing 3,500 shaft hp.

Built by Westland Aircraft Ltd. of Yeovil, England, the helicopter can fly with a load of 7,650 lb on one engine. With full load it cruises at 130 knots and has a range of 200 miles. Makers say that the "flying cut-away drawing" will take load units slung underneath the helicopter up to 5 tons in weight. It is expected to play a large role in engineering projects.

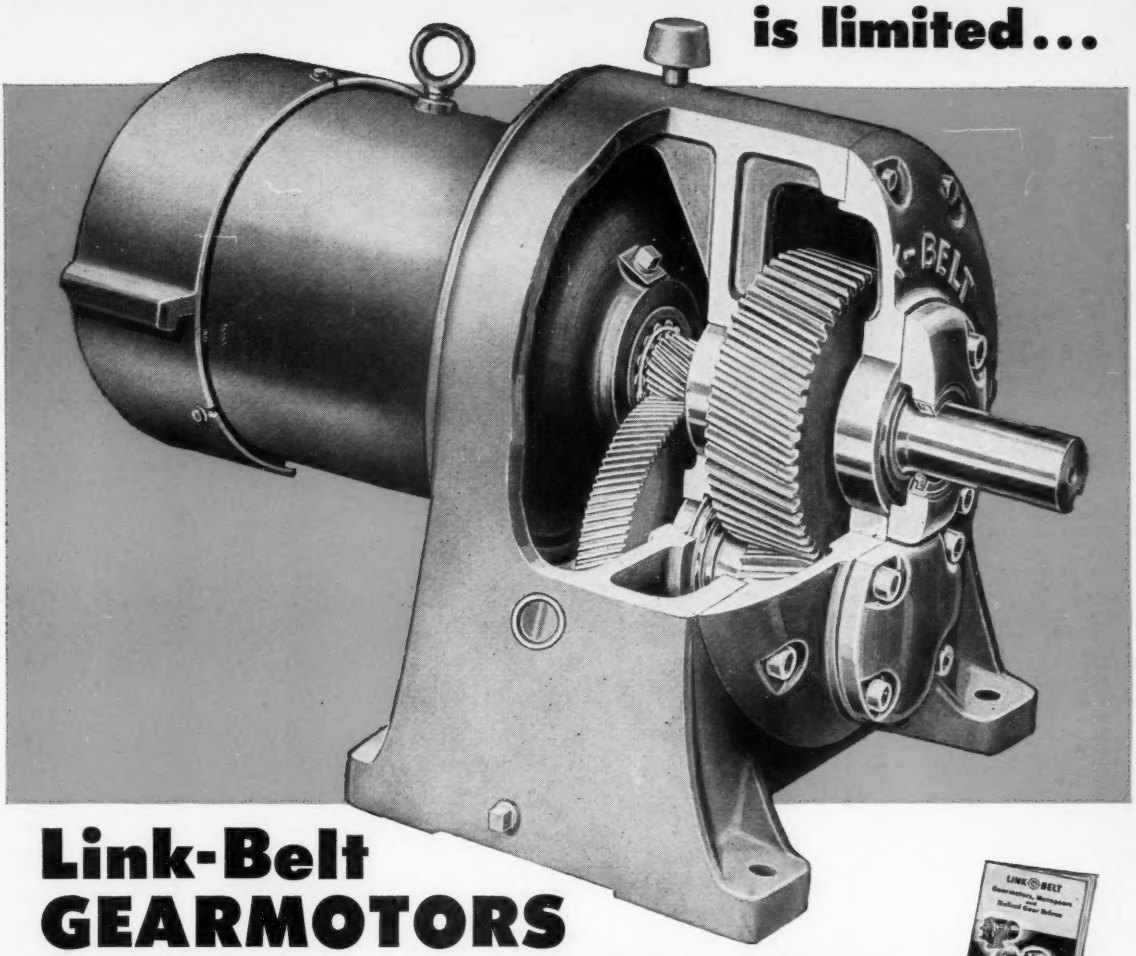
3,000-ton shear cuts hot steel slabs like butter



The big piece of equipment shown at left is a 3,000-ton hydraulic shear which will be installed in the U. S. Steel Corporation's Gary Steel Works. Its job is to cut hot slabs rolled in the new slabbing mill now being built.

Machinery was designed by Blaw-Knox Company and fabricated in the company's East Chicago works. Shear has a knife pressure of 6 million lb.

Efficient speed reduction where space is limited...



Link-Belt GEARMOTORS

With their integrally-mounted CEMA electric motors, Link-Belt Gearmotors are your economical answer to efficient speed reduction in minimum space. And to assure years of trouble-free service, they're built better these ways:

BUILT-IN ALIGNMENT of motors and gears results in lasting efficiency plus maximum safety. **HOBBED HELICAL GEARS** are rigidly mounted for smooth, quiet action. Pinions are heat-treated chrome-moly steel.

SHAFTS are precision machined and ground. **ANTI-FRICTION BEARINGS** withstand heavy loads.

AUTOMATIC SPLASH LUBRICATION system reliably supplies oil to all moving parts. **MAGNETIC DRAIN PLUG** removes ferrous particles from lubricant.

BUILT-IN POSITIVE BACK-STOP is available on all units.

LINK-BELT GEARMOTORS are designed to meet the most demanding operating conditions. And they're stocked in various horsepowers and ratios for immediate shipment from your nearest Link-Belt factory branch store. For details, contact your representative.

FOR MORE FACTS ON GEARMOTORS WRITE FOR BOOK 2247

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14,008

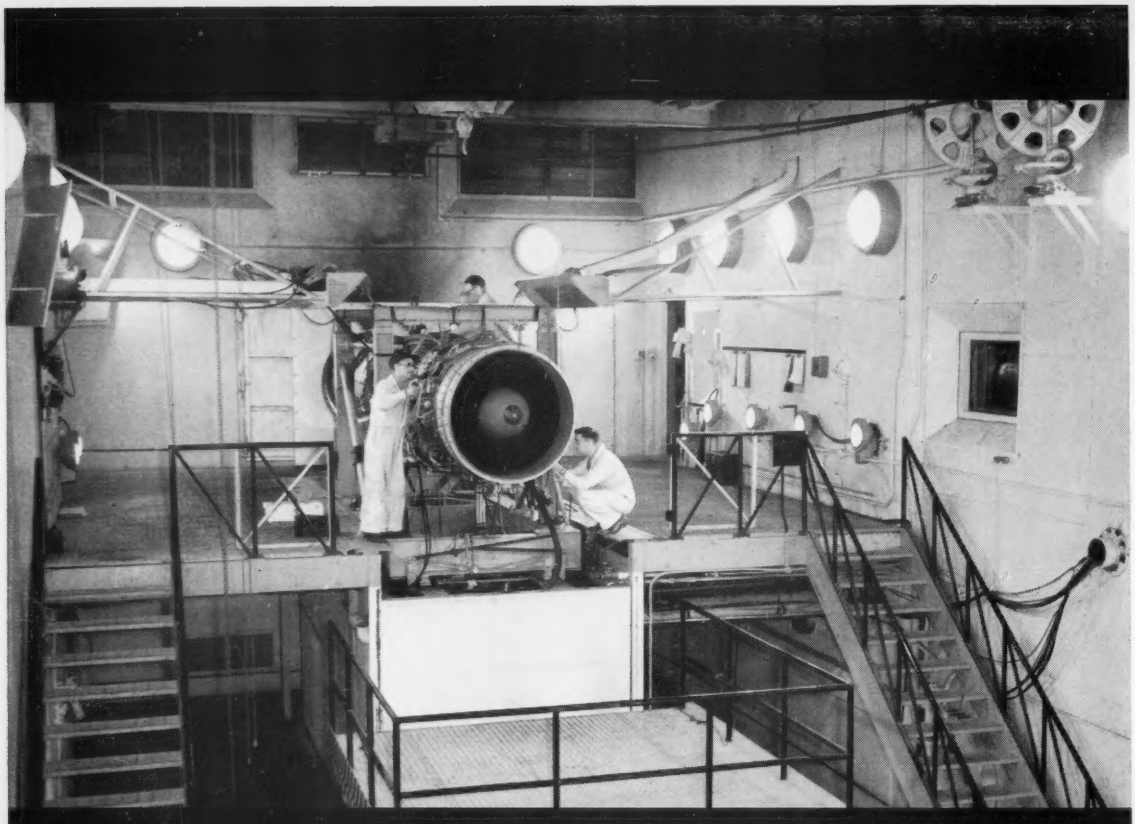
Get JOB-MATED drive combinations from the complete Link-Belt line

In addition to all three types of enclosed gear drives, Link-Belt builds variable speed drives, fluid drives, chains, sprockets, couplings, bearings, shafting, etc. All are pre-engineered for easy installation and maximum efficiency.

Parallel Shaft Gear Drives — ask for Book 2619

Worm Gear Drives — ask for Book 2324-A

Helical Gear Drives — ask for Book 2451



Rehearsal for Mach 3 at 100,000 feet

IROQUOIS development engines have completed over 5,000 hours of bench running in these test cells at Malton and in flight tests.

Over 100 hours were accumulated during a recent series of test runs at the NACA Lewis Flight Propulsion laboratory, Cleveland, Ohio.

Further tests will be conducted in Orenda's new high altitude facility to investigate IROQUOIS performance over the widest range of speed and altitude.

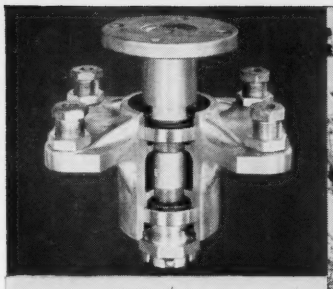
IROQUOIS test results at NACA Lewis Flight Propulsion laboratory, Cleveland, U.S.A.

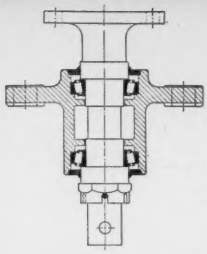
1. Probably highest dry thrusts recorded in North America for turbojets.
2. Successful operation under sustained high inlet temperatures.
3. Normal relights up to 60,000 feet, the limit of the tunnel, proved effectiveness of Orenda patented method.
4. Altitude handling improvements incorporated within two months.
5. Thrust/weight 5:1.
6. Thrust—in the 20,000 lb. class (without afterburner).

ORENDA *ENGINES LIMITED*

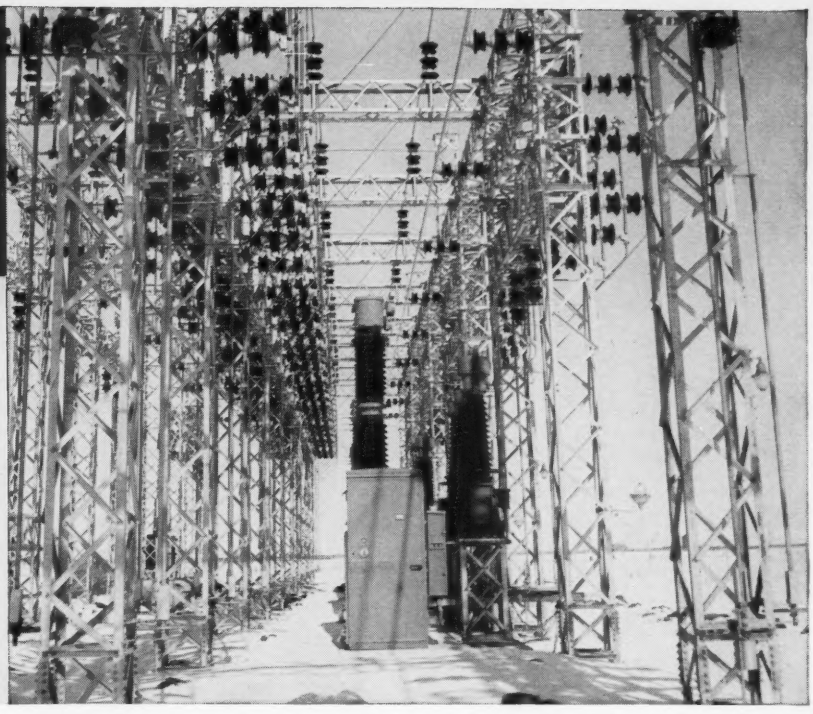
MALTON, CANADA

MEMBER: A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP





How **JAMES R. KEARNEY CORP. OF CANADA LTD.** mounts the base of its type KDHB outdoor disconnect switch on Timken bearings to assure positive performance, take heavy loads.



New switch in bearings! 230 TIMKEN bearings make right connections, under heavy loads, in any weather

THIS Kearney type KDHB disconnect switch does the vital job of making and breaking power circuits, making it possible to deliver power when and where needed. And it has to do it under all weather conditions—can't stick in snow or ice. All this, plus the heavy loads when the switches are mounted vertically or at an angle puts heavy demands on the bearings in the switch base. To assure trouble-free operation, James R. Kearney Corp. of Canada Ltd. specified two Timken tapered roller bearings for the rotating stack of each single pole switch. Some 30 three-pole switches are shown in the installation above.

Timken bearings assure easy switch rotation because they roll true, practically eliminate friction. Seizure won't occur. And they're adjustable—can be set to the most desirable setting for this kind of oscillating service. The taper and design of Timken bearings lets them take static as well as both radial and thrust loads in any combination. And full-line contact between rollers and races gives Timken bearings extra load-carrying capacity.

With Timken bearings closures are more effective, too. Dirt, dust and moisture stay out. Lubricant stays in. Condensation doesn't form to cause corrosion.

We even make our own electric furnace fine alloy steel, to be sure it's the best. For all these advantages, specify bearings trade-marked "Timken". The Timken Roller Bearing Company, Canton 6, Ohio, U. S. A. **CANADIAN PLANT:** St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN *Made in* **CANADA**

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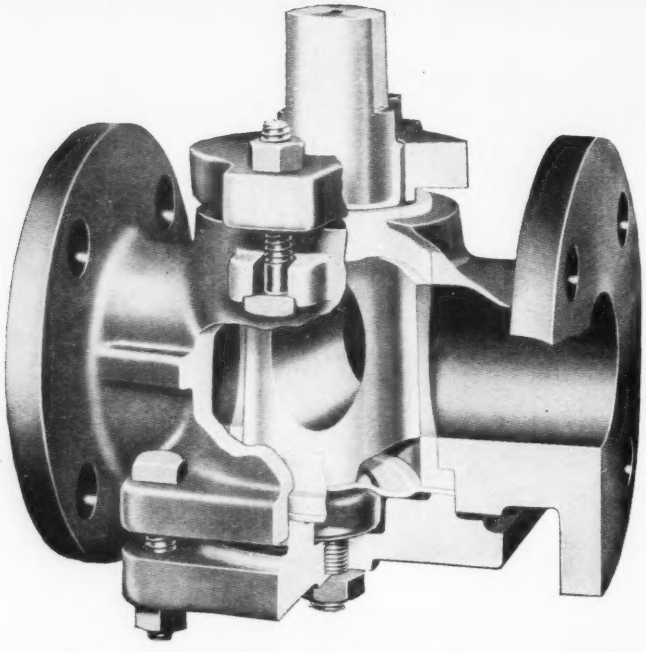
TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ⊂⊃ THE TIMKEN TAPERED ROLLER ⊂⊃ BEARING TAKES RADIAL ⊖ AND THRUST —⊖— LOADS OR ANY COMBINATION —⊖—

Here's the answer to your

Corrosive Handling Problem . . .



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- **Requires *No* Lubrication**
- **Will Not Leak or Seize**

The Durco Type F valve is a 150 lb. corrosion-resistant, non-lubricating plug valve designed for severe chemical services. It is sturdily constructed of Durimet-20, a stainless steel alloy whose resistance to corrosion is superior to conventional 18-8 types of stainless steels. The special alloy body and plug, separated by a reinforced Teflon sleeve, provides for long maintenance-free service. There is no metal-to-metal contact, no galling or sticking.

Durco Type F valves are available in a wide range of corrosion-resisting alloys including Type 316, Monel*, Nickel, Chlorimet 2, and others. Sizes range from ¾″ to 4″, with both screwed and flanged ends. In thousands of applications, the Durco Type F valve has proved to be an outstanding development in handling corrosives.

Why not test the performance of this efficient valve for yourself. Prompt delivery from our stocks at Montreal. Write today for bulletin V/4B for complete information.

*Registered trade name of International Nickel Company

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for an oil line pipe or a ship

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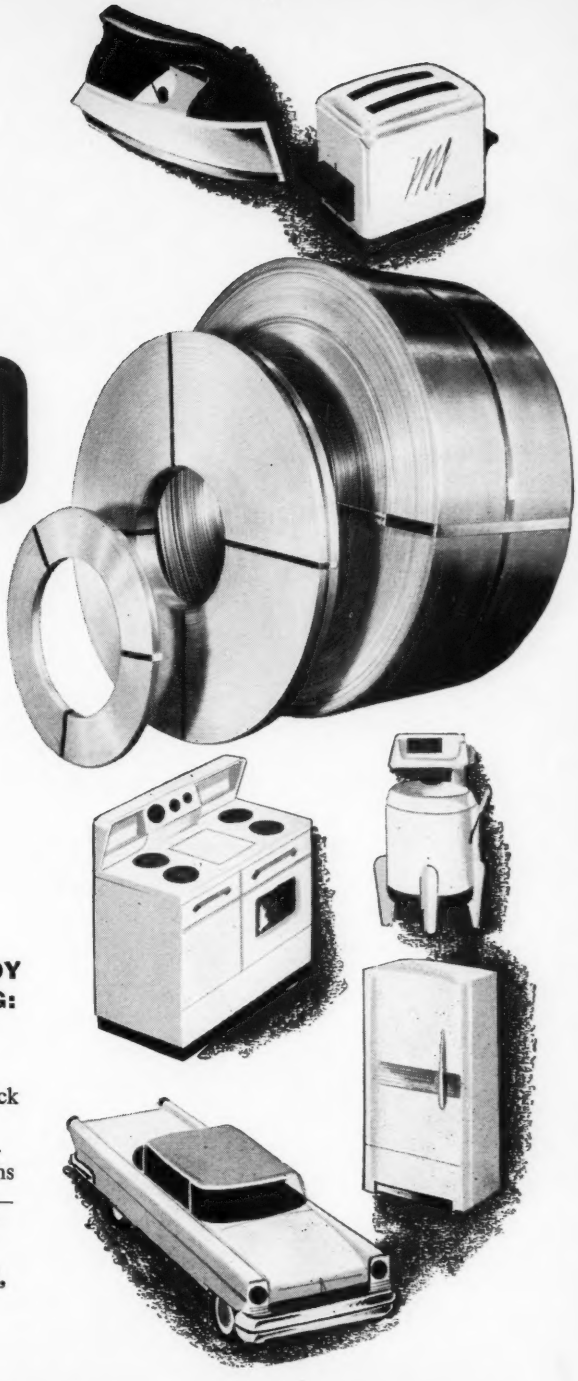
must be of suitable specification
properly processed for each
individual manufacturing requirement.



ALGOMA STEEL CORPORATION PRODUCES HIGH QUALITY FLAT ROLLED STEEL IN CARBON AND ALLOY GRADES, INCLUDING THE FOLLOWING:

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- Hot Rolled Pipe Skelp—mill or bevel edge—black or pickled and oiled—in coils or cut lengths
- Hot Rolled Sheets and Strip—mill or slit edge—black or pickled and oiled—in coils or cut lengths
- Cold Rolled Sheets and Strip—mill or slit edge—dull or bright (lustre) finish—Nos. 1,2,3,4 and 5 Temper—in coils or cut lengths
- Cold Rolled Electrical Sheets and Strip, in Field, Armature, Electrical and Motor grades

ALGOMA

ALGOMA STEEL
CORPORATION, LIMITED
Sault Ste. Marie, Ontario

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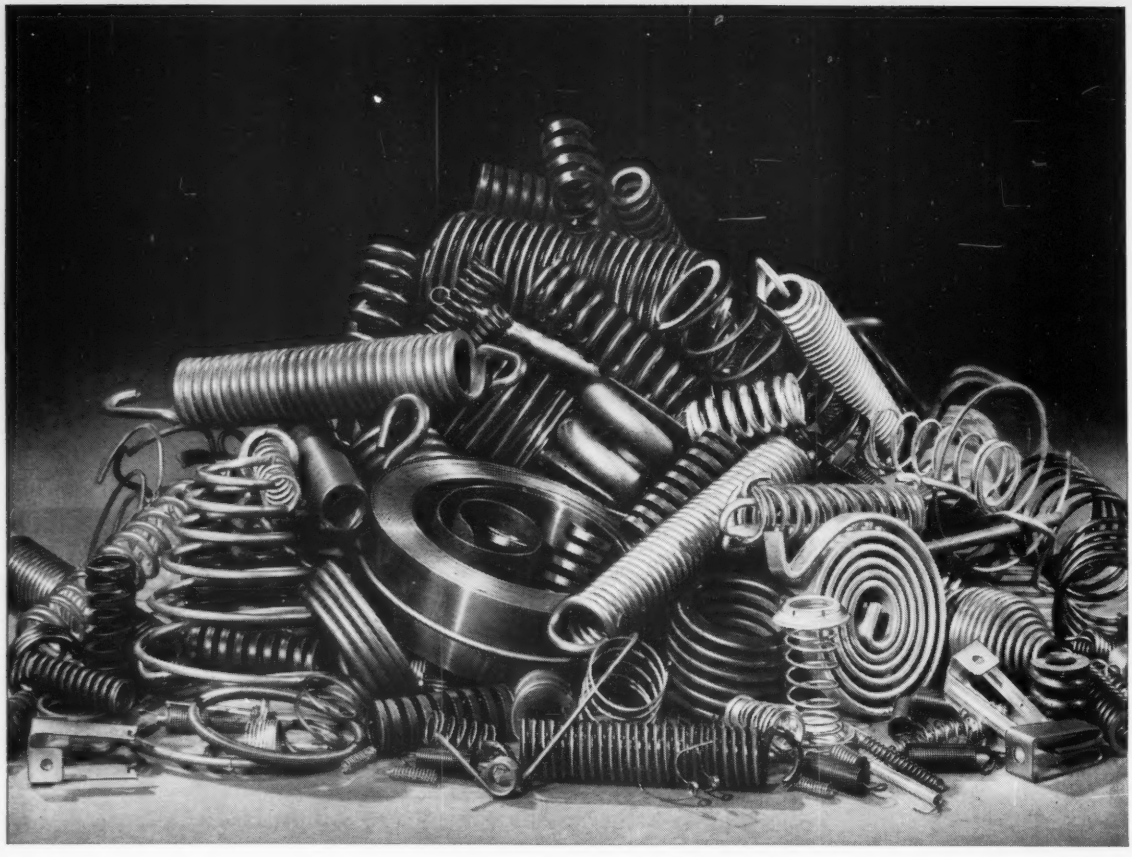

needle in a haystack?

Finding just the right spring can be costly and time-consuming. Even though springs look alike, each is different—depending on the job it has to do. Type, size, tension, temper, stress, and other complicating factors must be considered in their design and manufacture

If finding the right spring for *your* problem seems like "looking for a needle in a haystack," Wallace Barnes can help you. Our spring engineers are ready to accept your precision mechanical spring problem and help design the *right* spring to do your job *precisely* right.

Send for your free copy of
Spring Design and Selection—in Brief
our authoritative digest on spring engineering

Selecting the right spring is simple . . .

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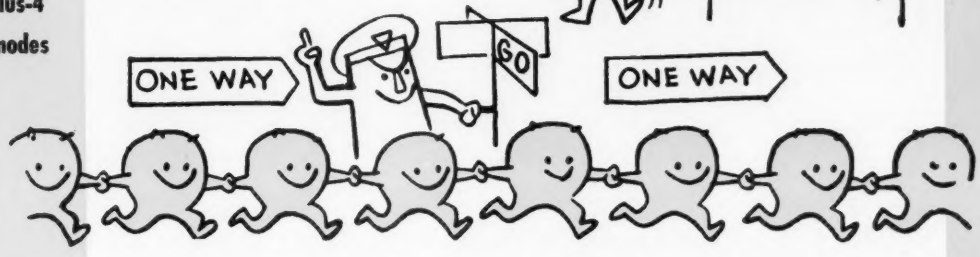
Anaconda Plus-4 Anodes

Phosphorus policemen arrest delinquent copper ions that want to play instead of work in the solution—thus preventing COPPER BUILD-UP and cutting cost of correcting solution.

Phosphorus policemen wake up lazy copper ions that want to settle down as SLUDGE in the bottom of the tank—thus making "bagging" and diaphragms unnecessary.

Your Work



Phosphorus traffic police keep copper moving uniformly to give you SMOOTH, HEAVY CATHODE DEPOSIT—up to 15% more cathode deposit per anode—and UNIFORM ANODE CORROSION leaving small "fish" that cut scrap losses.

PLATING COSTS LESS WITH ANACONDA "PLUS-4" ANODES

+1 no anode sludge (no "bagging" or diaphragms required)
+2 no copper "build-up" in solution
+3 smooth, heavy cathode deposits
+4 up to 15% more cathode deposit per anode

The playful characters above give perhaps an oversimplified explanation of a laboratory development now saving acid-copper electroplaters, electrotypers and electroformers a lot of time and money.

Metallurgists have found that if copper used as anodes contains a small but precisely controlled percentage of phosphorus, all the copper moves uniformly through the acid-copper solution to the object being plated. The phosphorus seems to act like a policeman.

Anaconda "Plus-4" Phosphorized Copper Anodes are the result. They have been proving their superiority in acid electroplating tanks in many parts of Canada. Write for publication C-5. Anaconda American Brass Limited, New Toronto, Toronto 14, Ont.

C-5722

ANACONDA*

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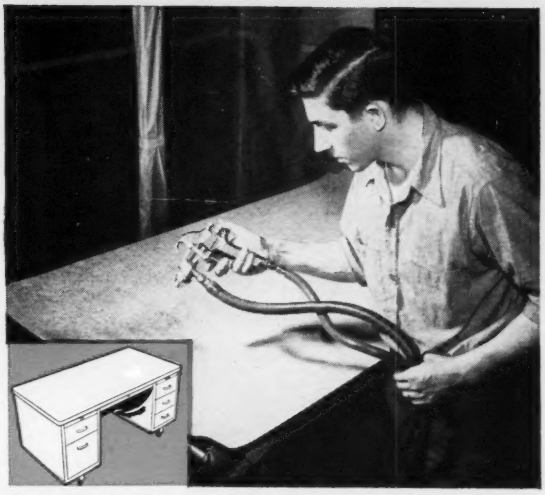
write for gear unit bulletin 368-53G

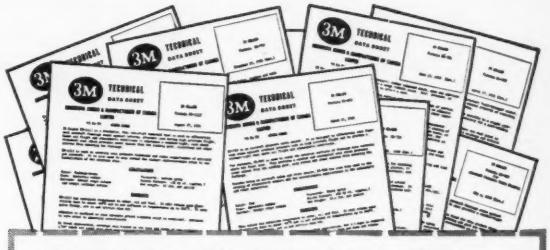
DOMINION ENGINEERING
COMPANY LIMITED
INDUSTRIAL DIVISION
MONTREAL TORONTO WINNIPEG VANCOUVER

TRANE CO. OF CANADA LTD. SAVES TIME insulating air conditioners by using specially designed 3M Adhesives. These adhesives hold the insulation tightly to the metal. No drying time is needed. The insulation never comes loose.



OFFICE SPECIALTY MFG. CO. LTD. SAVES COSTS in production by using another specially designed 3M Adhesive. Every desk they make has its top laminated with 3M Adhesive. Speed of application and holding power are just two of the reasons.

CONCRETE PIPE LIMITED SAVES LEAKS by using rubber gaskets adhered tightly to concrete by a 3M Adhesive. The combination of the adhesive and gasket defies the elements.



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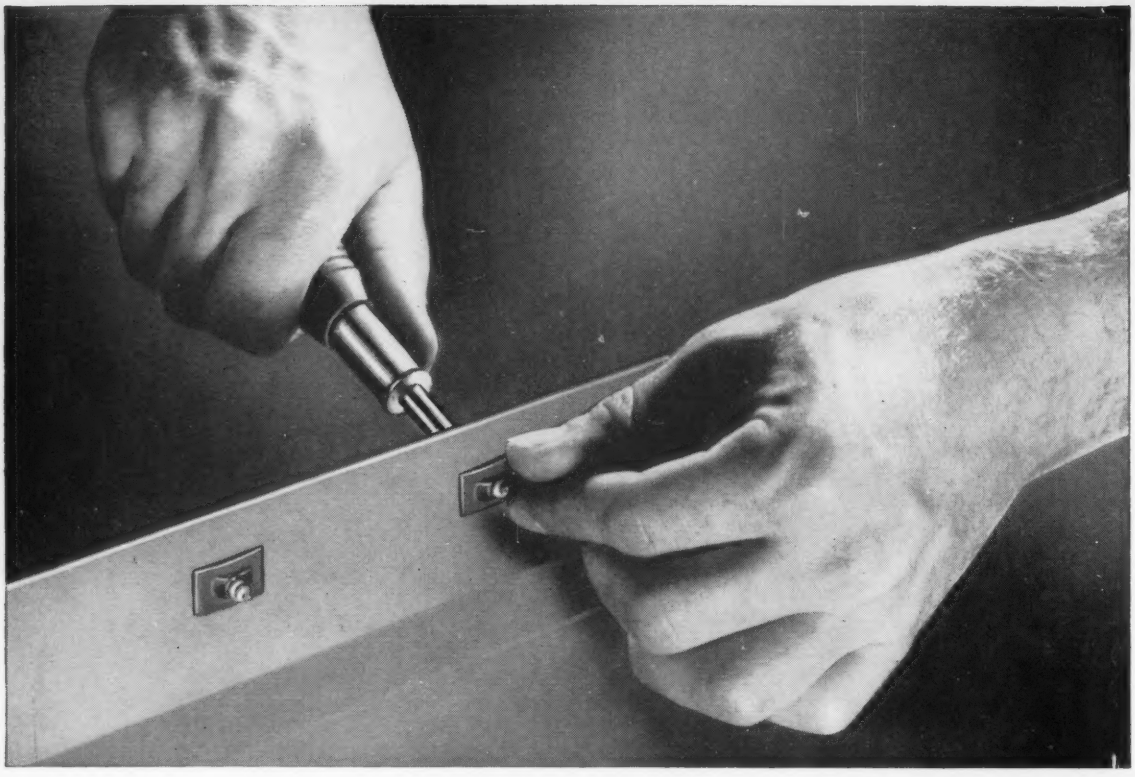

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...they'll do better work faster with

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FASTENERS

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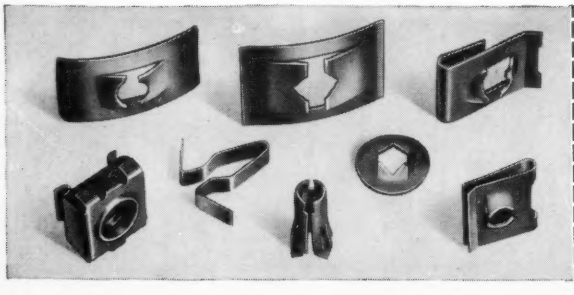
In even the most mechanized plant, there is still a good deal of hand assembly to be done. It's vital to your profits that these hand operations be done quickly and expertly with no waste motions. To be sure that your big investment in these hands is paying a good return, look into Speed Nut Fasteners. These modern efficient fastening devices are cutting costs for thousands of leading manufacturers throughout the world. Mail this coupon today for complete information.



33-5802

DOMINION FASTENERS LIMITED

a Geo. A. Tinnerman *corporation*

HAMILTON, ONTARIO. Branches: Toronto, Montreal.

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Please send me complete information on how Speed Nut Fasteners can reduce my costs and improve my product.

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More reasons why OEM designers specify

THE BELLOWS AIR MOTOR

—the air cylinder with the built-in valve

- **no extra valves—all operating controls are built-in**
- **choice of valve types: low voltage, JIC, pilot-actuated, mechanically actuated**
- **responds to starting impulse instantly—no lag, no stutter**
- **fits well in tight quarters, on moving machine elements**
- **no cumbersome piping, requires only a single air connection**
- **available in five bore sizes: 1¼, 1¾, 2½, 3⅝, 4½"**
- **made in any stroke length**
- **over 150 skilled field engineers the world over to handle your fluid power requirements.**

They all add up to:

LESS DESIGN TIME REQUIRED,
LOWER FACTORY COST TO INSTALL!

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"The Bellows Air Motor in Original Equipment Design." Write Dept. DE-1258, The Bellows Co., Akron 9, Ohio.

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PNEUMATIC DEVICES OF CANADA, LTD.

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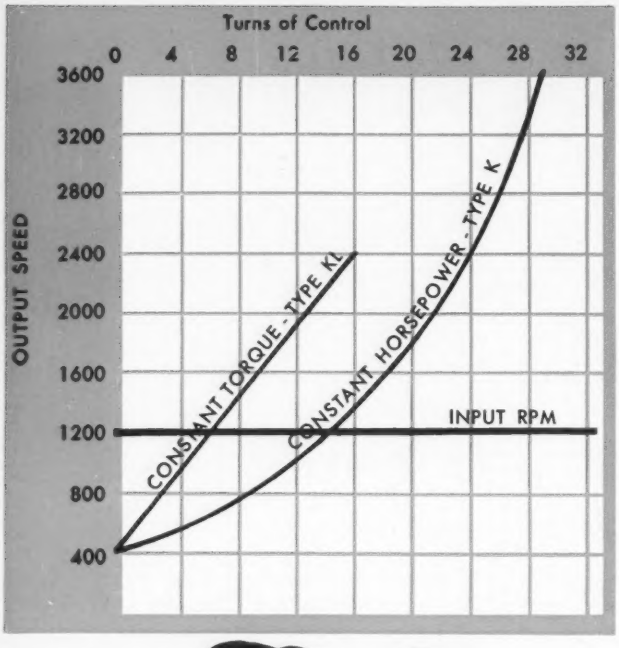
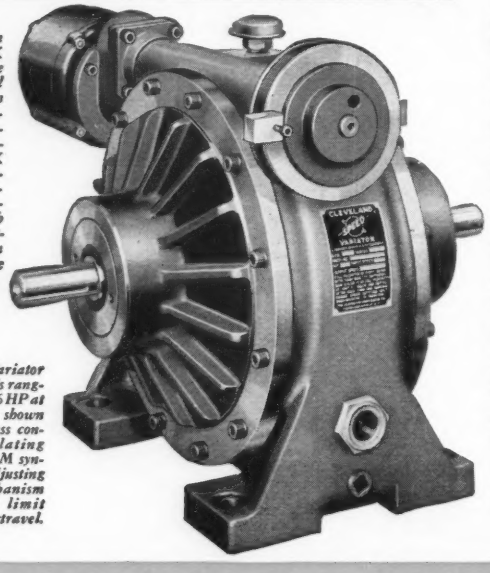


Typical speed regulation curves for the Types K and KL Variators. Type KL offers a linear speed regulating pattern, often an advantage in automatic control applications. Output speed regulation of the Type K Variator follows a geometric progression pattern. Starting at the minimum output speed, each turn of the speed regulating wheel produces a fixed percentage increase in output shaft speed.



The Cleveland Speed Variator is available in 18 models ranging from fractional to 16 HP at 1750 input RPM. Unit shown at right, used in process control, has speed regulating worm driven by 75 RPM synchronous motor, with adjusting shaft indicating mechanism modified to actuate limit switches to prevent overtravel.

CLEVELAND SPEED VARIATOR

Accurately Provides Dependable, Infinitely Variable Speed Control

ANNOUNCED late in 1954, the new Cleveland Speed Variator met instant, enthusiastic acceptance. Engineers and designers of industrial equipment already have put thousands of units into use on such varied equipment as cigarette making machines, textile machinery, metalworking machinery, pharmaceutical equipment, transfer tables, conveyors and experimental and testing equipment of many types.

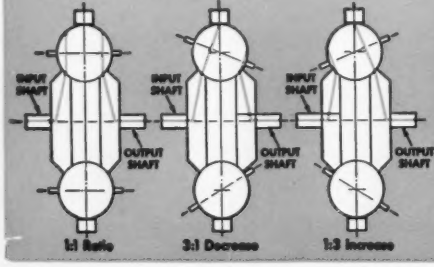
Infinitely variable, the Cleveland Speed Variator gives stepless speed over a full 9:1 range—from ⅓ to 3 times input speed. Output speed can be adjusted by either a hand wheel on the Variator or by manual or automatic remote control.

The Cleveland Speed Variator offers these major advantages:

1. An extremely compact unit with input and output shafts in line and rotating in the same direction.
2. Almost any input speed up to 1800 RPM can be used—either clockwise or counterclockwise rotation.
3. Rated for constant horsepower output over a 9:1 or 6:1 range; or for constant output torque over a 6:1 range.
4. Speeds infinitely variable over entire range of adjustment.
5. No slippage—positive torque response mechanism adjusts in direct proportion to the loads encountered.
6. Long life and minimum maintenance due to absence of belts or complicated linkages.
7. Ample bearing support for overhung pulleys on both input and output shafts.

Write for Bulletin K-200 for detailed description with photographs, sectional drawings, rating tables and specifications.

HOW THE CLEVELAND SPEED VARIATOR WORKS



Power is transmitted from input shaft to output shaft through alloy steel driving balls which are in pressure contact with discs attached to the two shafts.

Relative speeds of the shafts are adjusted by changing the positioning of axles on which the balls rotate (diagram, right, shows cutaway Variator with hand regulating wheel).

"It's the Drive That's on the Ball."

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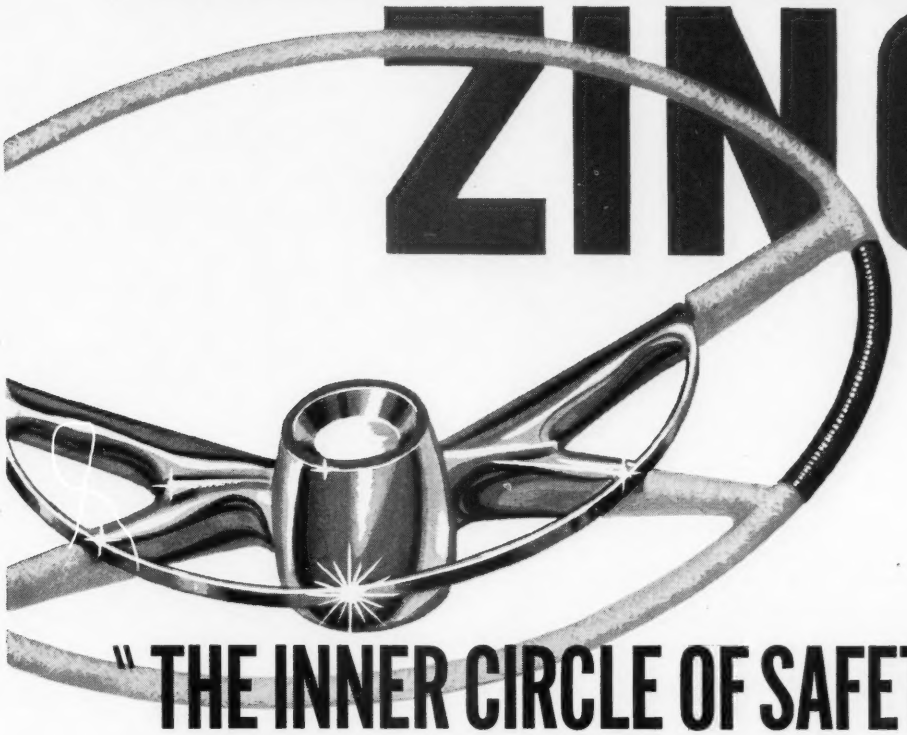
die cast from TADANAC ZINC



"THE INNER CIRCLE OF SAFETY"

An automobile horn may startle and annoy you . . . or it may save your life!

Following the curve of the steering wheel just inches away from the driver's hand, the horn ring on a modern automobile stands ready to sound a warning to pedestrians and other vehicles. It's strong, attractive and durable—die cast in Zinc!

For flexibility of design, combined with the economy of accurate, low temperature, high speed operation, die casters choose alloys of Zinc. And, for consistent high quality, assured supply and prompt delivery, Tadanac Zinc is the preferred brand for die casting alloys!

If you require information or assistance regarding your Zinc die casting operations, contact our Technical Service Staff. Your inquiries will receive prompt attention.

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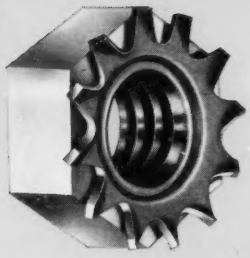
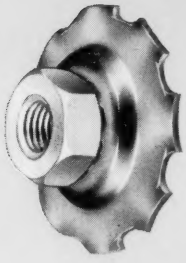
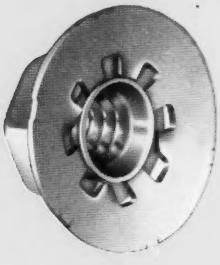
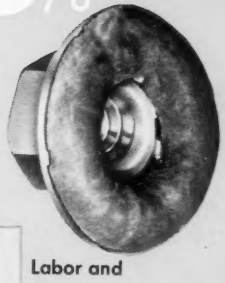
KEPS® ONE UNIT REPLACES TWO OR MORE...



CUTS COST 26%







Keps—mechanically pre-assembled Shakeproof® Lock Washers and nuts—eliminate handling two or more separate parts on the assembly line. Case studies in hundreds of applications prove that Keps save time and substantially reduce costs.

For example, the total cost of ordinary nuts and separate washers averages $15.67 per thousand (chart above at left). Compare that with Keps (above right)—labor and burden are cut in half because Keps do not require hand assembly of nut and washer—total cost is down to $11.56 per thousand. On the average, Keps save 26% of total fastening cost! Your best opportunity for real savings is not in lower fastener prices but in labor saving fasteners like Keps. A complete discussion of this important concept is contained in the Shakeproof "Price-Per-Thousand" booklet. Be sure to write for your copy today.

Keps are available in a wide range of sizes in Standard Machine Screw and Finished Hexagon Series. Other types that offer even greater cost-saving opportunities are Dished Washer Keps, Domed Washer Keps, Sealing Keps and special-dimension Keps. Try them now!

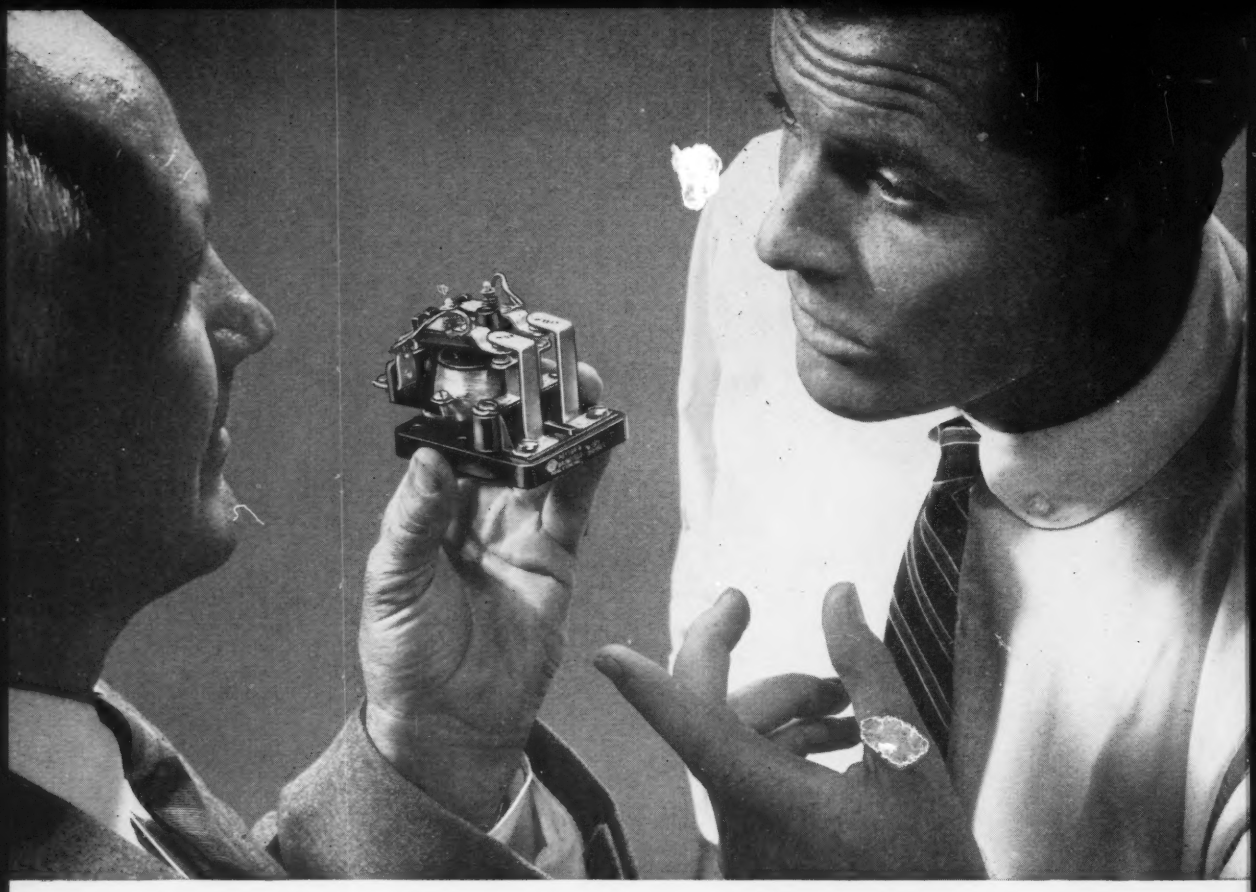
SHAKEPROOF / FASTEX

DIVISION OF CANADA ILLINOIS TOOLS LTD.

67 SCARSDALE ROAD · DON MILLS, ONTARIO

Send for free sample kit

Test Keps yourself. See how you can save assembly costs immediately with only one part to handle instead of two or more!



HERE'S WHY P&B's PR POWER RELAY IS PREFERRED

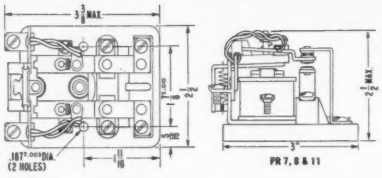
for high current/voltage switching

HEAVY DUTY construction means long-term dependability when switching up to 20 amperes (double break contacts). Here is a ruggedly built relay, packed with high quality features, yet economically priced.

The PR's full floating movable contact carrier, for example, provides excellent contact pressure and ample wipe for self-cleaning contact action. The coil is centrifugally impregnated with top-grade varnish to eliminate moisture traps.

Contact arrangements up to DPDT are available. The PR has been adapted for printed circuitry and heavy duty plug-in applications.

All standard AC actuated PR relays may carry the UL and Canadian Standards Association seals of approval. Write or call for complete information.



GENERAL SPECIFICATIONS:
Breakdown Voltage: 1500 volts rms min. between all elements and ground.
Ambient Temperature: DC: —55° to +85°C.
AC: —55° to +55°C.
Terminals: Heavy duty screw type. Standard printed circuit pins or plug-in on request.
Enclosures: PR dust cover.

CONTACTS:
Arrangements: Up to 2 Form C (DPDT).
Material: 5/16" dia. silver or silver cadmium oxide. (Others available)
Load: Single break: 15 amps; Double break: 20 amps at 115 volts 60 cycle AC resistive.

AUXILIARY CONTACTS:
Arrangements: 1 Form A, B or C.
Material: 3/16" diameter silver
Rating: 5 amps at 115 volts 60 cycle AC resistive.

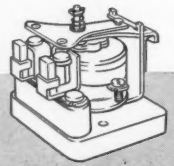
COILS:
Resistance: 64,000 ohms maximum.
Power: 1.8 watts DC; 9.8 volt-amps AC.
Duty: Continuous AC or DC (DC coils will withstand 10 watts at 25°C).
Insulation: Centrifugally impregnated with high quality varnish.
Mountings: 2 holes .187" diameter 1⅞" o.c.

PR Relays Approved By Underwriters' Laboratories and Canadian Standards Association

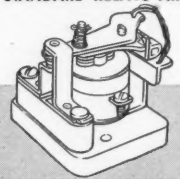
Type	Contact Arrangement*	Type	Contact Arrangement*
PR1AY	SPST-NO	PR5AY	SPDT
PR2AY	SPST-NC	PR7AY	DPST-NO
PR3AY	SPDT-NO-DM	PR8AY	DPST-NC
PR4AY	SPDT-NC-DB	PR11AY	DPDT

These relays are available in any of the following operating voltages: 6, 12, 24, 48, 115, 208, 230, or 440 volts 50/60 cycles AC.
The contacts are rated at: 13 amps, 115 volts AC. 6.5 amps, 230 volts AC. 1 hp for 115 or 230 volt AC motors. Any relays deviating electrically or physically from these standard models will not carry U/L or CSA approval.
*Read: NO normally open, NC normally closed, DB double break, DM double make.

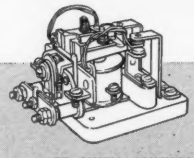
P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR



PR RELAY WITH MAGNETIC BLOW-OUTS
Models PR3 and PR7 can be supplied with alnico magnets to suppress arcs on DC loads over 1200 watts.

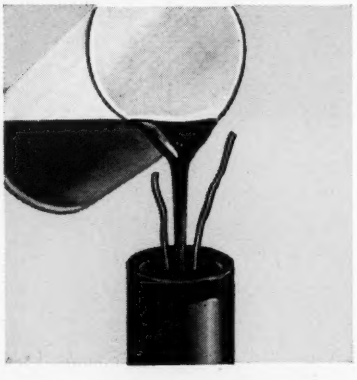


SINGLE POLE DOUBLE THROW VERSION
PR 5 (SPDT) has all the heavy-duty features of other models in this series.



PR WITH AUXILIARY CONTACTS
All PR models can be equipped with auxilliary contacts in 1 Form A, B, or C arrangements.

AMF **POTTER & BRUMFIELD** CANADA LTD.
Guelph, Ontario



A long, trouble-free life is the forecast for electrical parts protected with RCI EPOTUF epoxy resins. Insulation made with these resins and appropriate hardeners is tough enough to surpass the most rigorous electrical and mechanical demands. Room temperature curing means no heat of reaction to harm delicate components.

Elements encapsulated, embedded or potted in EPOTUF epoxy resins are virtually free of failure, thus minimizing the need for costly maintenance and increasing the overall efficiency and reliability of the complete unit.

EPOTUF resins harden with outstanding adhesion to metals, glass, ceramics and other materials. They offer high mechanical strength and superior dielectric properties. The liquid nature of these resins permits penetration of fine crevices, and their low shrinkage assures highest dimensional stability.

If these numerous advantages of durable, dependable, corrosion-resistant EPOTUF epoxy resins fit your application, get in touch with RCI.

Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol
Hydrochloric Acid • Formaldehyde • Glycerine • Phthalic Anhydride
Maleic Anhydride • Sebacic Acid • Ortho-Phenylphenol • Sodium Sulfite
Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenate
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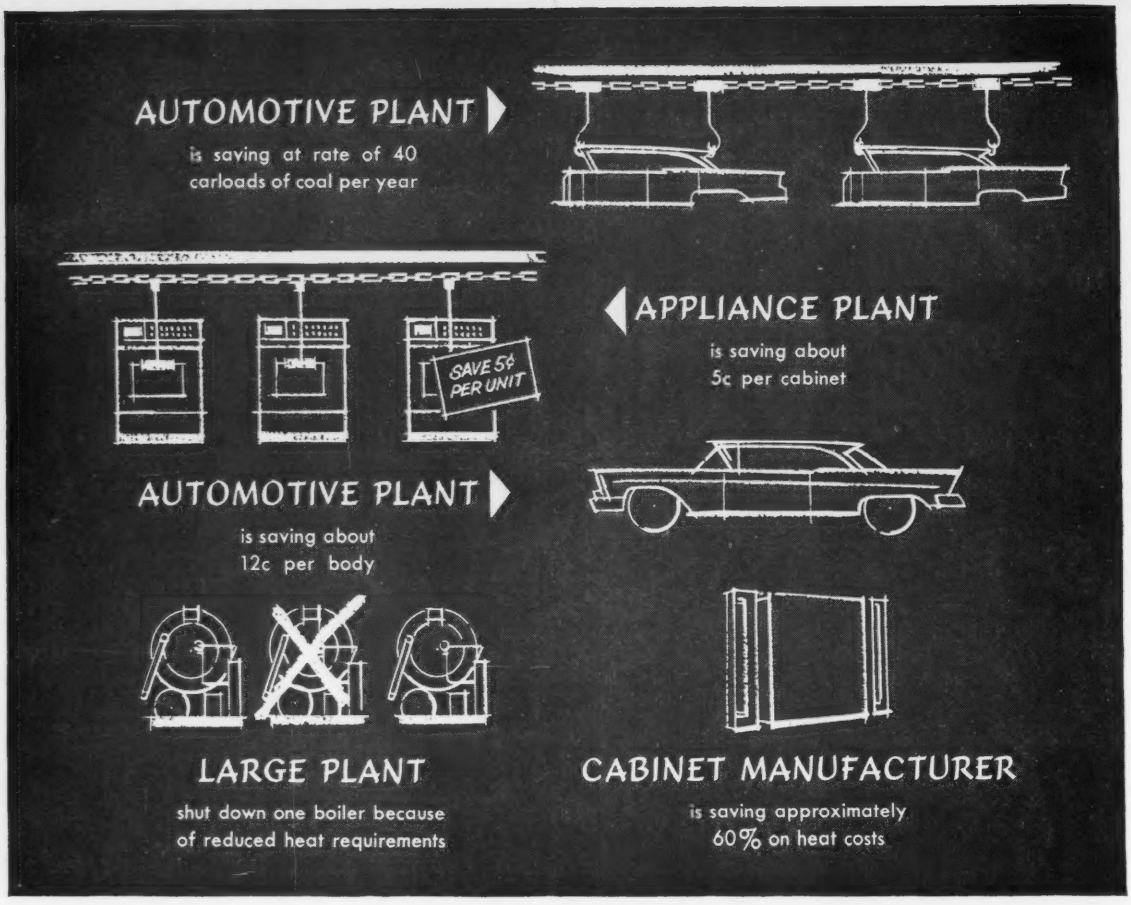

high quality coatings...spectacular savings, too! New COLD BONDERITE SYSTEM

These are not isolated cases. Everyone saves when they change from conventional hot phosphating to the new Cold Bonderite System!

The difference is in heat required. Cleaner, rinse and Bonderite operate 40° to 75° cooler than in conventional installations.

Results produced by the Cold Bonderite System equal the highest Bonderite quality standards. Chemical costs are comparable to hot systems.

Many plants, from the largest on down, have changed to the Cold Bonderite System in their finishing lines. They've cut costs drastically. You can, too. Write or call today!

PARKER RUST PROOF COMPANY
OF CANADA, LTD.
Rexdale Blvd., Rexdale (Toronto) Ontario

BONDERITE corrosion resistant paint base
BONDERITE and BONDERLUBE aids in cold forming of metals
PARCO COMPOUND rust resistant
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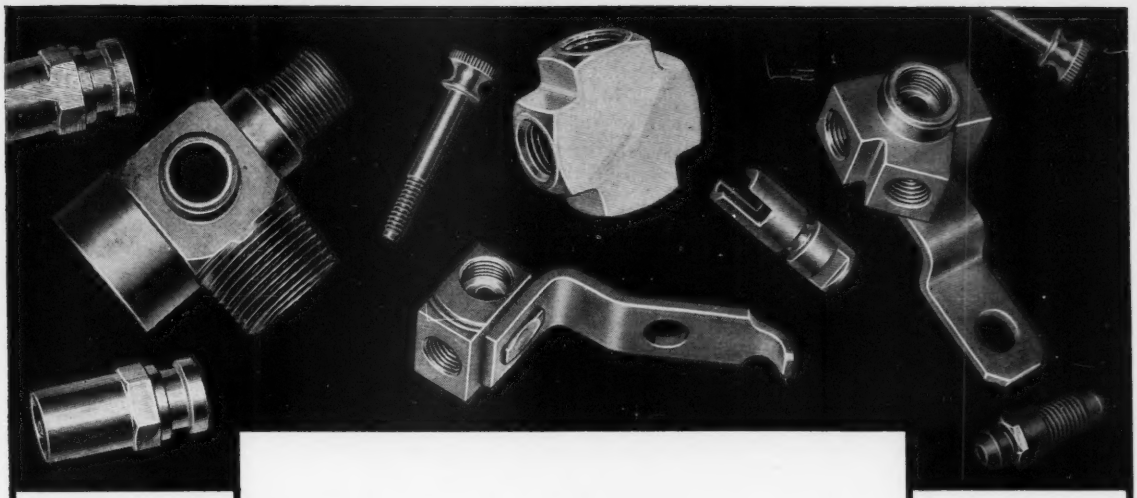
TROPICAL heavy duty maintenance paints since 1883

Since 1914— leader in the field

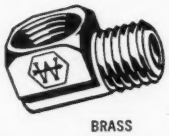
*Bonderite, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.



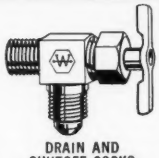
Any screw machine part to meet your need

We'll make it out of brass, steel, aluminum or any machineable material to meet your specifications. A battery of 66 multiple and single spindle automatic screw machines (capable of machining from 1/32" through to 2 5/8" diameter material) are ready to go to work. For the highest production *quality*, in any *quantity* at the lowest *cost*—call in Weatherhead.

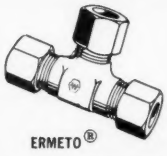
DASH CONTROLS



BRASS



DRAIN AND SHUTOFF COCKS



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HOSE ASSEMBLIES

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SCREW MACHINE DIVISION

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SM-3-8

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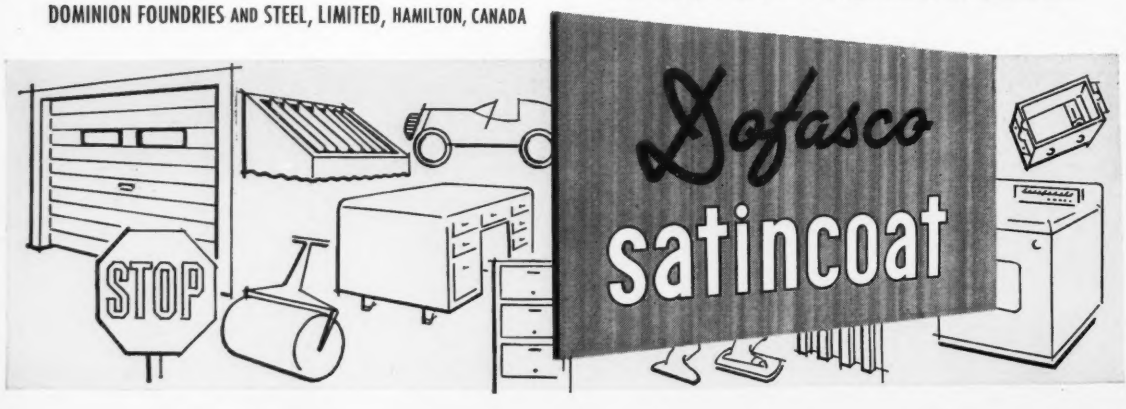
satincoat is a versatile zinc-coated steel that is ideal for an endless variety of fabricated products. It helps you to reduce your manufacturing costs and make a better product. For complete details, see your Steel Jobber or write Dofasco.

satincoat is available in a complete range of sizes and gauges, and in sheet or coil form.

- satincoat *resists rust—protects your product during manufacture —and long, long after.*
- satincoat's *rust-resisting zinc-coating will not crack or peel during forming or fabrication.*
- satincoat *takes paints, lacquers or enamels without surface preparation.*

Any stamping oils, greases, etc., picked up during processing will, of course, need to be removed before paint is applied. This is ordinary painting procedure regardless of the material used.

DOMINION FOUNDRIES AND STEEL, LIMITED, HAMILTON, CANADA



The Human Eye, Nature's inspiration for the camera, can convert wavelengths of blue-green light measuring as little as 400 microns into visual perceptions that are truly life-size. Yet this entire human mechanism occupies space less than 1″ in diameter.

Tiny New Potentiometer, shown actual size, is designed to add space-saving precision to missile and aircraft servo mechanisms. Two MPB bearings in it assure accurate, low-torque shaft rotation — a vitally important benefit in sub-miniature components.

Man With Miracles. This is Maurice Hebert, one of MPB's Sales Engineers. He'll personally help you choose the correct MPB bearing to reduce friction and increase the precision of your instruments — while keeping your operating costs low with trouble-free service.

Miracles in Miniaturization

ACTUAL SIZE OF THE MPB BEARINGS IN POTENTIOMETER SHOWN ABOVE

The Smaller The Better is often completely true. Engineers now know that miniaturization is the surest method of developing new or improved components for many of the latest developments in modern industry. But, as components become smaller, the problems of maintaining high precision and long service life become larger — and the call for MPB bearings constantly increases. MPB answers with the most experienced engineers in the miniature bearing industry, and advanced research facilities . . . producing over 500 types and sizes of bearings from ⅜″ O.D. down, with specials as required. We welcome your request for engineering advice, our catalog, or both.

Write MPB, Inc., 712 Precision Park, Keene, N.H. In Canada: Lyman Tube & Bearings, Ltd., Montreal, Toronto, Hamilton, London and Winnipeg.

MINIATURE PRECISION

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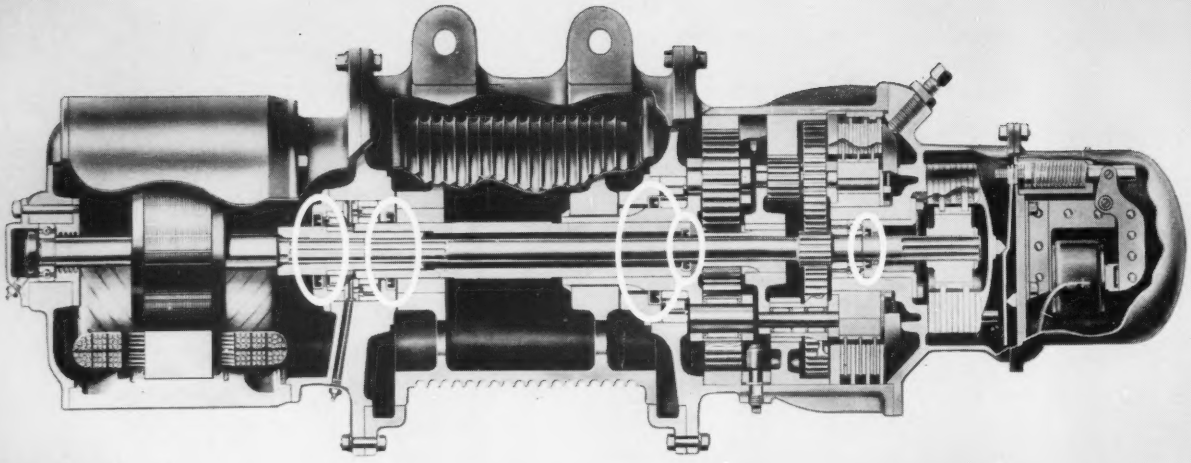
MORE ABOUT THE GARLOCK **2,000**



General-purpose KLOZURE Oil Seals (Model 63 cutaway right) afford complete protection at important bearing locations (circled above) on the Shepard-Niles "Liftabout" Hoist.

Garlock Klozure* Oil Seals

assure durable, dependable performance on tough sealing jobs

Friction and bearing wear, hazardous to any industry, are especially harmful in materials handling. That's why Shepard-Niles and other leading crane and hoist manufacturers specify Garlock KLOZURE Oil Seals for complete bearing protection. Shepard-Niles "Liftabout" is typical of how Garlock KLOZURES not only exclude dust and foreign matter from bearings but also retain the important lubrication—both of which add to greater dependability during rugged hoist operation.

Designing Garlock KLOZURES into your equipment protects bearings with oil seals that are durable, economical, and easy to replace. Garlock KLOZURES can be applied on low, medium, or high speed service. Whether your application is general-purpose in nature, or there's a specific job to be done, Garlock has a KLOZURE design for you.

KLOZURES are another of the Garlock 2,000 . . . two thousand types of packings, gaskets, and seals for every need. The only complete line. It's one reason you get unbiased recommendations from your Garlock representative.

Call him or write for KLOZURE Catalog 20.

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GARLOCK

THE GARLOCK PACKING COMPANY OF CANADA LTD.

General Offices: Toronto, Ont.
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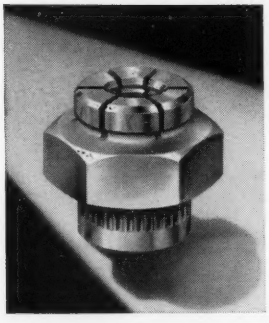
Packings, Gaskets, Oil Seals, Mechanical Seals, Molded and Extruded Rubber, Plastic Products

How FLEXLOC clinch nuts save production time



If you are building assemblies of thin-section materials, you can make secure bolted connections with FLEXLOC clinch nuts. Use them instead of cage nuts, anchor nuts and weld nuts. They are easy to install—no riveting or welding is required.

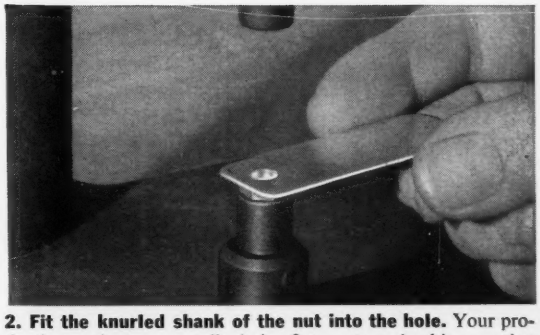
When you design with 1-piece, all-metal FLEXLOC clinch nuts, you simplify production operations by eliminating complicated nut-and-lockwasher assemblies. And the nuts cannot fall off or get lost during maintenance operations.

When you thread in a screw, the FLEXLOC locks it wherever wrenching stops (as soon as 1½ screw threads or more project through the locking section). Locking action is positive and dependable. No matter how many times your product must be reassembled during maintenance or repair, the FLEXLOC holds securely every time. Its locking life is virtually unlimited. It cannot be loosened by vibration.

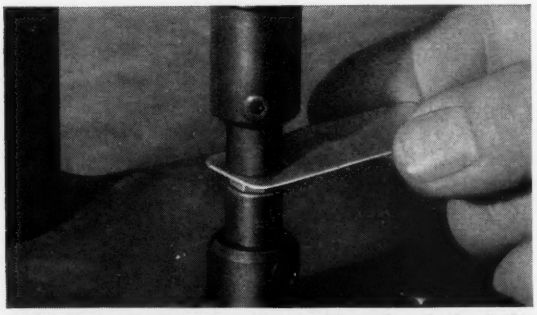
Standard FLEXLOC self-locking clinch nuts come in sizes #0 through ¼ in., for use in materials from 1/32 to 3/16 in. thick. They are made in alloy steel, stainless steel, brass and aluminum. FLEXLOC clinch nuts and clinching tools are available through your authorized industrial distributor. Call him today. Write us for complete specifications, or for information about your special locknut problem. STANDCO CANADA, LTD., 193 Bartley Drive, Toronto 16, Ontario.

It's easy to install a FLEXLOC clinch nut

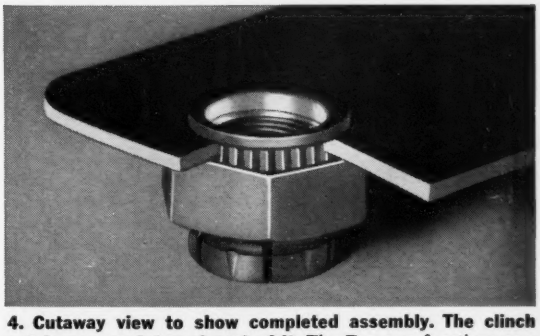
1. Hole in your subassembly accommodates the knurled shank of the FLEXLOC. The holding fixture is fitted with an inexpensive FLEXLOC dolly tip.



2. Fit the knurled shank of the nut into the hole. Your production engineers can easily design fixtures to make this operation completely automatic.



3. Clinch the shank to the subassembly with a single stroke. This electric press is equipped with a FLEXLOC punch tip which also can be used with an ordinary hammer.



4. Cutaway view to show completed assembly. The clinch nut is now an integral part of it. The FLEXLOC functions as a tapped hole—one that will lock a screw securely in place.

FLEXLOC locknuts are sold through authorized industrial distributors

FLEXLOC®

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Du Pont of Canada launches a new era in Canadian Plastics ...

with the immediate start in construction of its new St. Clair River Works near Sarnia, Ontario—an ultra-modern, automated plant which will manufacture revolutionary linear polyethylene resins for the Canadian market. In addition, nearing completion this fall, is a $300,000 plastics sales service laboratory at Kingston, Ontario, designed for research into the development of the linear polyethylene production process—and the future consumer applications.

Linear polyethylenes are an amazing new family of resins with hitherto unmatched properties. They are vastly stiffer, stronger and harder than plastic products made from the familiar conventional types of polyethylene, with outstanding proven resistance to heat, chemicals, abrasion and vapor transmission.

The young lady from Du Pont, above, is demonstrating only some of the variety of plastic articles which will be made from linear polyethylenes to benefit Canadians in the years to come. The products range from bottles which can safely be immersed in boiling water to rigid and high-gloss bowls, utility baskets, semi-rigid water and chemical piping, lab utensils and high tenacity rope.

WATCH FOR THESE NEW PLASTICS
FROM DU PONT OF CANADA

For any further information on Du Pont Plastics write Room A-10, Du Pont Company of Canada (1956) Limited, Box 660, Montreal, Que.

DU PONT
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THERMO-SETTING ACRYLIC ENAMEL . . .

From Pittsburgh's Springdale Research Centre comes news of a distinctive new development in industrial enamels. Duracron Thermo-setting Acrylic Enamel is not merely another modification of an existing vehicle—it is a basically new chemical composition and a revolutionary departure from the baking enamels used today. Because of its unique properties Duracron is particularly suitable for the finishing of household appliances, air-conditioning units, metal furniture, partitioning, siding, tile and cabinets—in brief, any surface on which it is desirable to improve present baking enamels.

Only new Duracron offers you all these advantages over other baking enamels:

- Superior adhesion to bare metal or primer.
- Outstanding toughness, hardness, and impact resistance either as a one-coat enamel or over primer.
- Remarkable colour and gloss retention for prolonged periods.
- Greatly increased resistance to detergents.
- Will not show stains from grease, inks, fruits, mustard, ketchup, etc.
- Gives improved resistance to salt spray, humidity and other corrosive atmospheres.
- Provides a sanitary, taste-free, mar-proof liner for food cabinets.
- Retains film continuity under severe impact.
- Available in clear, white and a range of colours.

Additional information on new Duracron is available by writing to:

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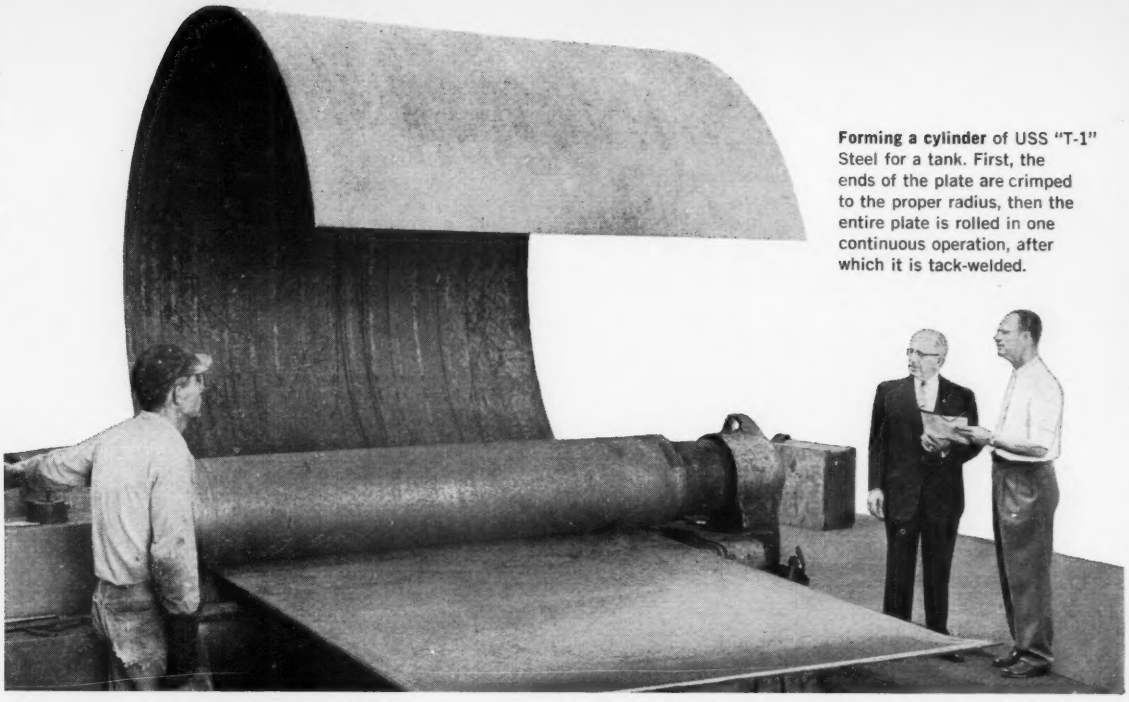

Forming a cylinder of USS "T-1" Steel for a tank. First, the ends of the plate are crimped to the proper radius, then the entire plate is rolled in one continuous operation, after which it is tack-welded.

Stronger than ever

"T-1" Steel Plates now furnished to 100,000 psi minimum yield strength

Since its introduction six years ago, USS "T-1" Steel has been a notable bargain—a bargain in the sense that the tremendous strength of this constructional alloy plate steel has enabled drastic weight reductions in structures, pressure vessels and equipment of all kinds. With the new facility, USS "T-1" Steel is an even better buy. Because today, USS "T-1" Steel delivers 11% more strength at no increase in price. Experience with our new line means that when you buy "T-1" Steel plates from 3/16" to 2½" thick (incl.), you get 100,000 psi minimum yield strength instead of the 90,000 psi previously furnished. Minimum tensile strength has been boosted from 105,000 to 115,000 psi; maximum tensile strength remains at 135,000 psi. Ordinarily, strength costs money, but in this case, no; and the potential for reducing dead weight and/or adding brawn is even greater.

Other conditions available. If you wish, of course, we'll still furnish USS "T-1" Steel to 90,000 psi min. y.s. Plates over 2½" thick will in any case be 90,000 psi min. y.s., as will Firebox Quality plates ¼" to 2" (incl.), produced to meet the requirements of ASME Boiler Code, Case 1204-3.

For extremely abrasive service, we still sell "T-1" Steel plates quenched and tempered to 321 minimum Brinell. At this high hardness level, no other mechanical properties apply.

And superb toughness. USS "T-1" Steel would be useless in many applications if it had no more toughness than is normally expected of steel at such high strength levels. But here's low temperature toughness that's an eye opener: 30 ft.-lbs. at plus 10° F., based on longitudinal Charpy V-Notch-type test, or 15 ft.-lbs. at minus 50° F., based on longitudinal or transverse Charpy Keyhole type test.

Firebox Quality USS "T-1" Steel plates from ½" to 2½" thick will exhibit these minimum average values at standard testing locations when tested in accordance with standard testing procedure. If you are not an engineer, this simply means that "T-1" Steel has a combination of strength and toughness unmatched by any steel in its price range.

NEW Mechanical Properties
of USS "T-1" Constructional Alloy Steel Plates
(3/16" to 2½" incl.)

• 100,000 psi minimum yield strength • 115,000 psi minimum tensile strength • 135,000 psi maximum tensile strength • 18% minimum elongation in 2" • 50% minimum reduction of area for plates over ¾" to 2½" thick incl. • 40% minimum reduction of area for plates ¾" thick and under.

United States Steel Export Company

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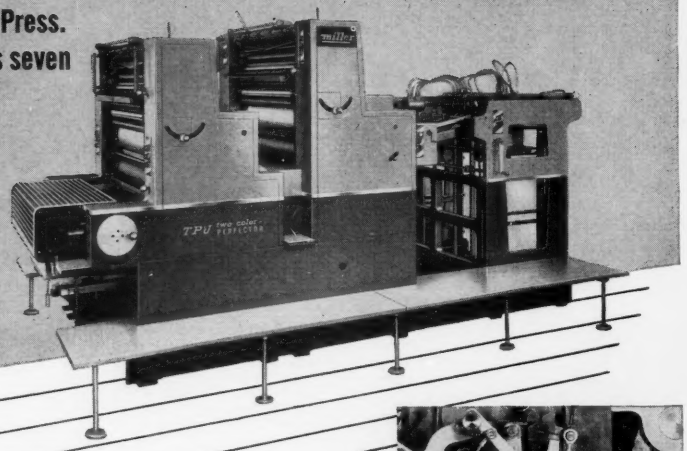
USS and "T-1" are registered trademarks

Misalignment is compensated for *Automatically*

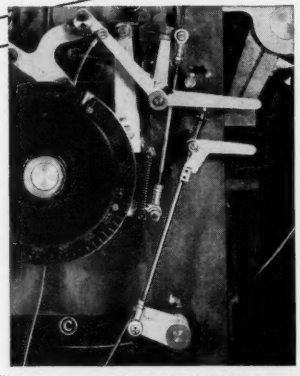
The Miller Printing Machinery Co. has introduced the Miller TPJ Two Color-Perfector Offset Press. In the design of this press, Miller uses seven

HEIM *Unibal*®

SPHERICAL BEARING ROD ENDS

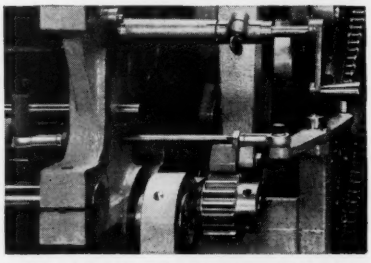


The TPJ is a sheet-fed offset press which converts from printing two colors on one side of the sheet to one color on both sides of the sheet. It can be switched from one to the other in a matter of minutes. It operates at high speeds and prints sheets up to 23" x 36".



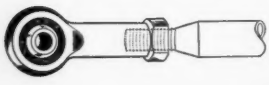
Major section of the first unit trip linkage, where Unibal Rod Ends were chosen to compensate for any slight misalignment, and because they are less expensive than special connections for this application.

These were chosen for several reasons, the principal one being that dimensional and squareness tolerances do not have to be held as close when using the Unibal, as any misalignment is compensated for automatically. The Heim Unibal has a single ball rotating in bronze raceways housed in an outer member or cartridge. The single ball has universal motion to correct misalignment . . . the larger surface supporting area offers greater load ratings for substantially smaller dimensions . . . assembly is simple and fast . . . there is a wide choice of sizes in both male and female types.



Portions of the side guide operating mechanism showing the use of Unibal Rod Ends to connect a walking motion operated by a face cam to a transverse motion.

Heim bearings are sold through the country's leading bearing distributors. Write for complete catalog and/or engineering help.



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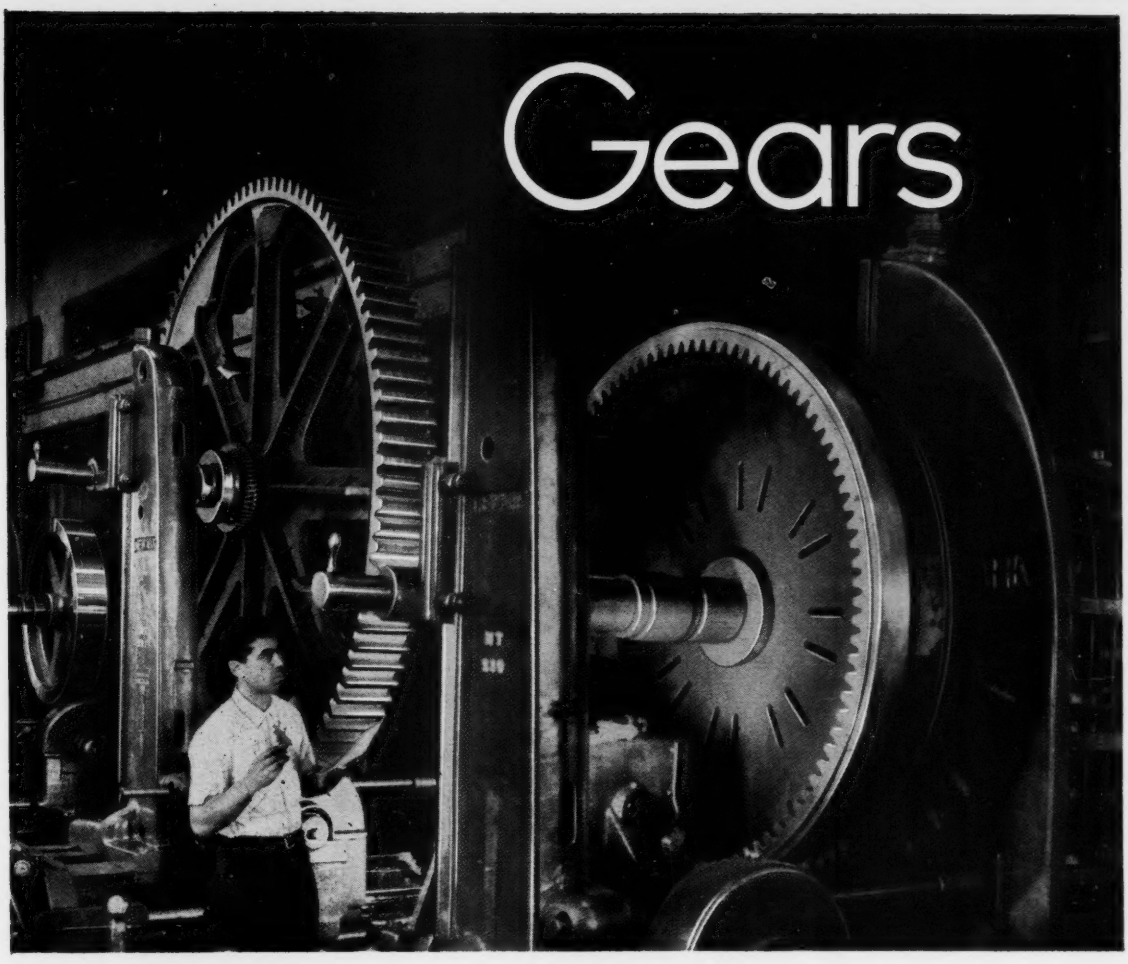
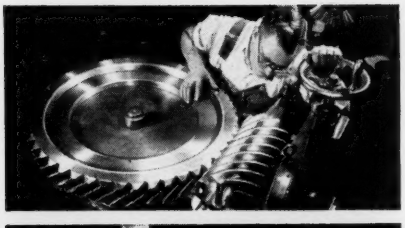
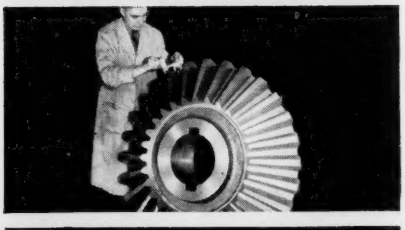
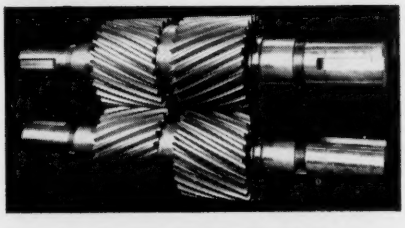
SPECIFY HEIM UNIBAL SPHERICAL BEARINGS AND ROD ENDS FOR ALL PUSH-PULL AND LINKAGE APPLICATIONS AND WHERE MISALIGNMENT MUST BE COMPENSATED FOR









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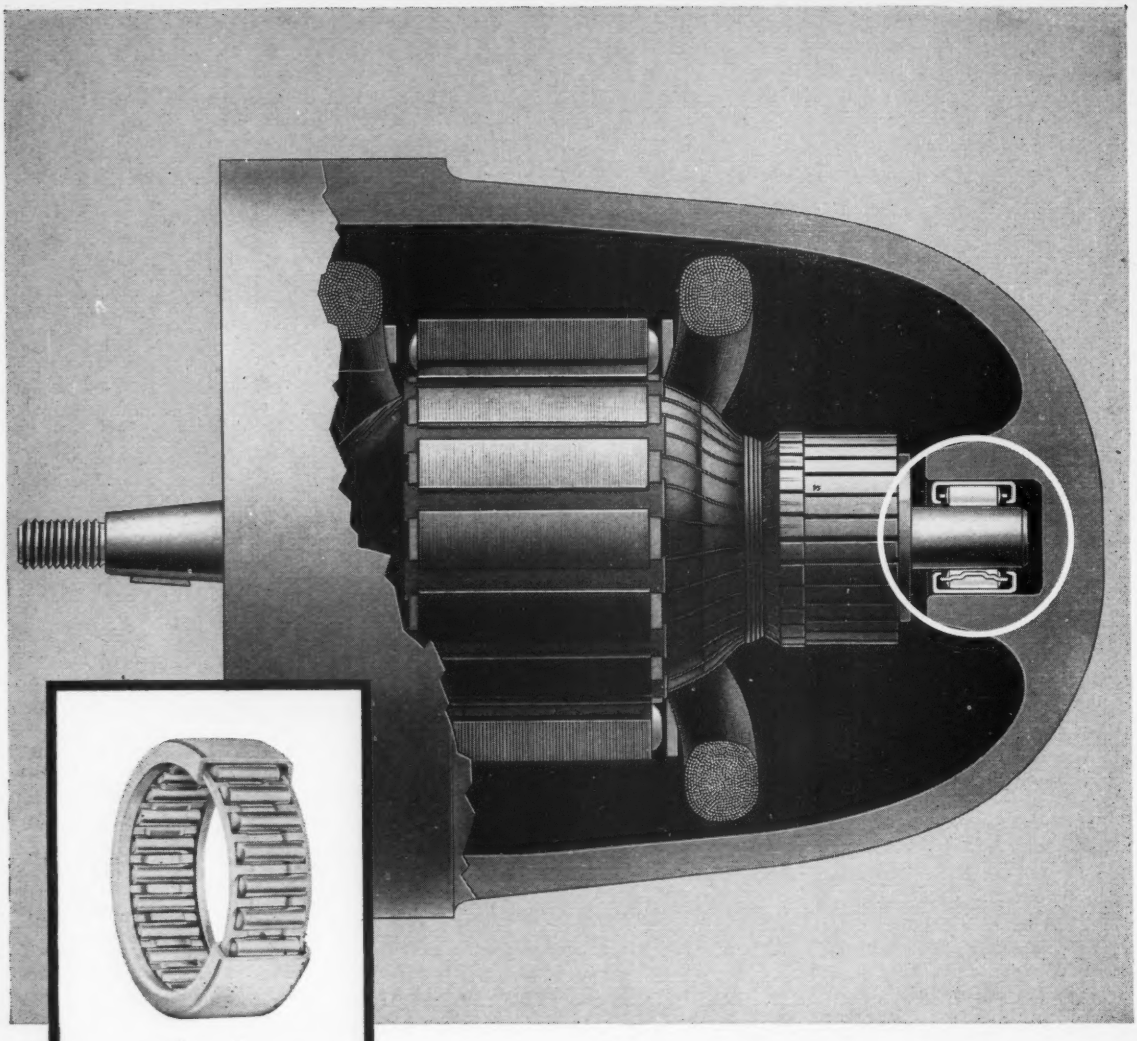

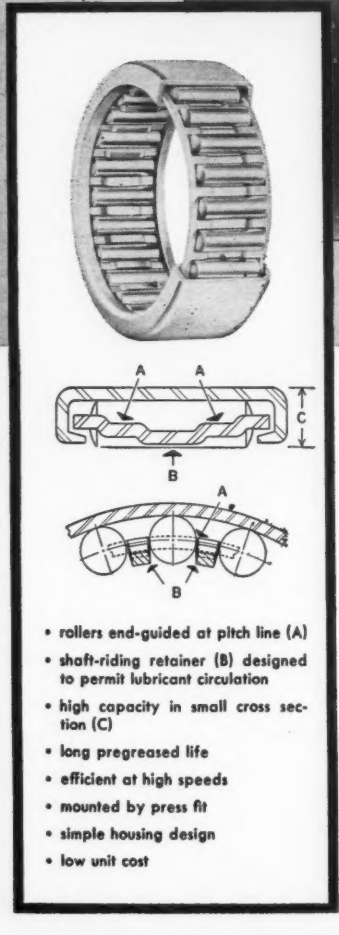

- rollers end-guided at pitch line (A)
- shaft-riding retainer (B) designed to permit lubricant circulation
- high capacity in small cross section (C)
- long pregreased life
- efficient at high speeds
- mounted by press fit
- simple housing design
- low unit cost

Save up to 50%
on armature bearing costs!

Low unit cost of the new Torrington Drawn Cup Roller Bearing reduces armature bearing cost as much as 50%. This unique bearing gives excellent service at high speed and permits prelubrication for life.

Test installations and service applications show the bearing performs efficiently at speeds up to 25,000 rpm in intermittent service of 1000 hours and more. In such service, initial lubricant lasts the life of the motor. Most applications require no seals. This, with the simplicity of housing design, contributes further to economy.

Designers are invited to evaluate the Torrington Drawn Cup Roller Bearing for such applications as generators, power tools, electric mixers, vacuum cleaners and other appliance motors where considerations of cost, speed, efficiency and light weight are paramount.

Services of Torrington's engineering staff are offered to assist you in design developments of every type of electric motor. **The Torrington Company, Limited, 925 Millwood Road, Toronto 2, Ont., Canada.**

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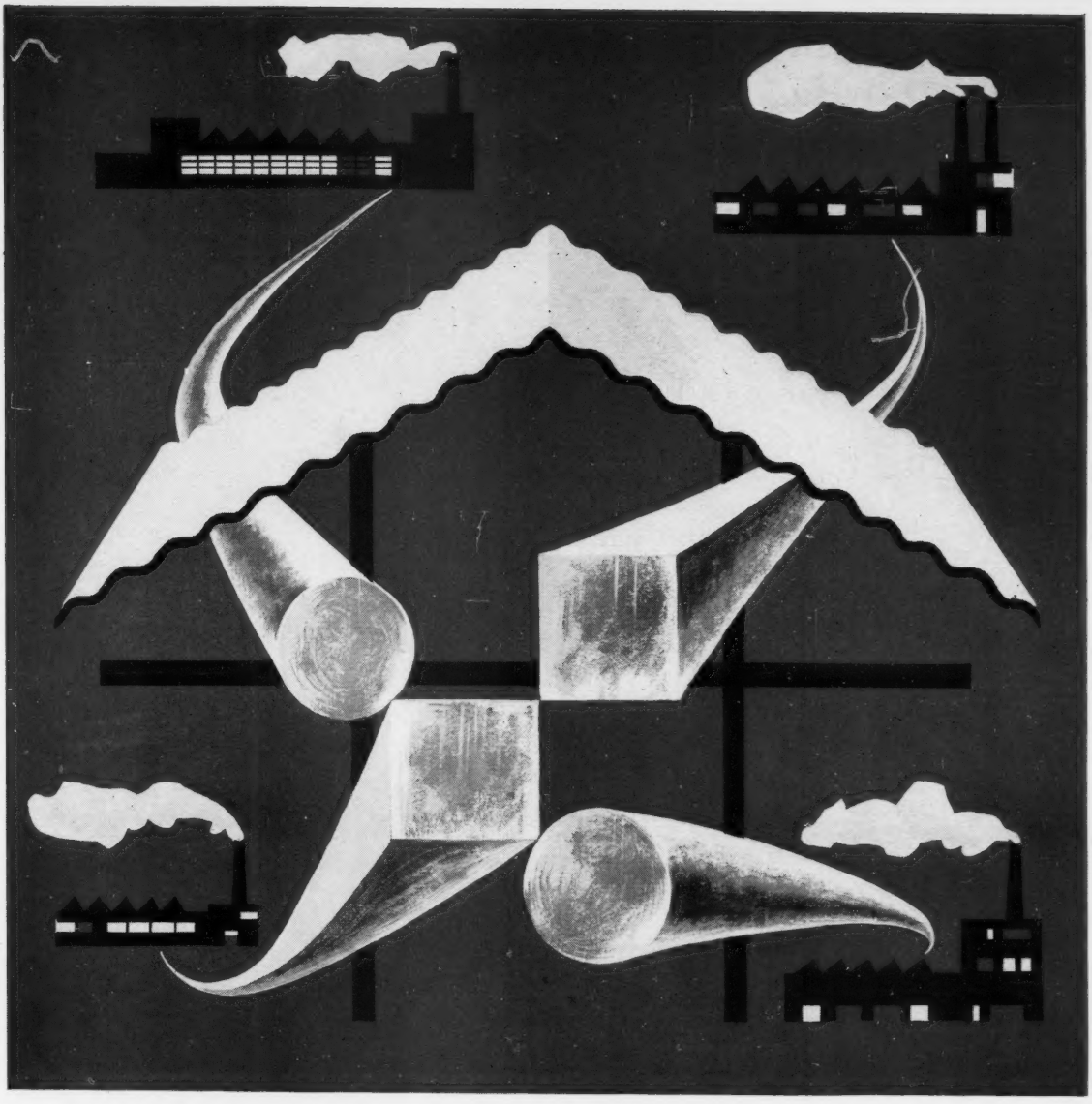

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Let Atlas stock your tool steels

Fully stocked Atlas warehouses in all the major industrial centres mean that all your tool steel requirements can be met from stock.

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No matter which way the wind blows with your blower unit requirements—belt-driven, direct drive or radial-axial mixed flow—Torrington has the solution to your problems.

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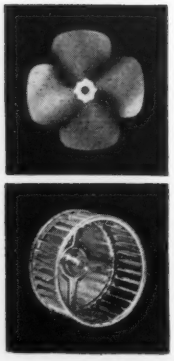

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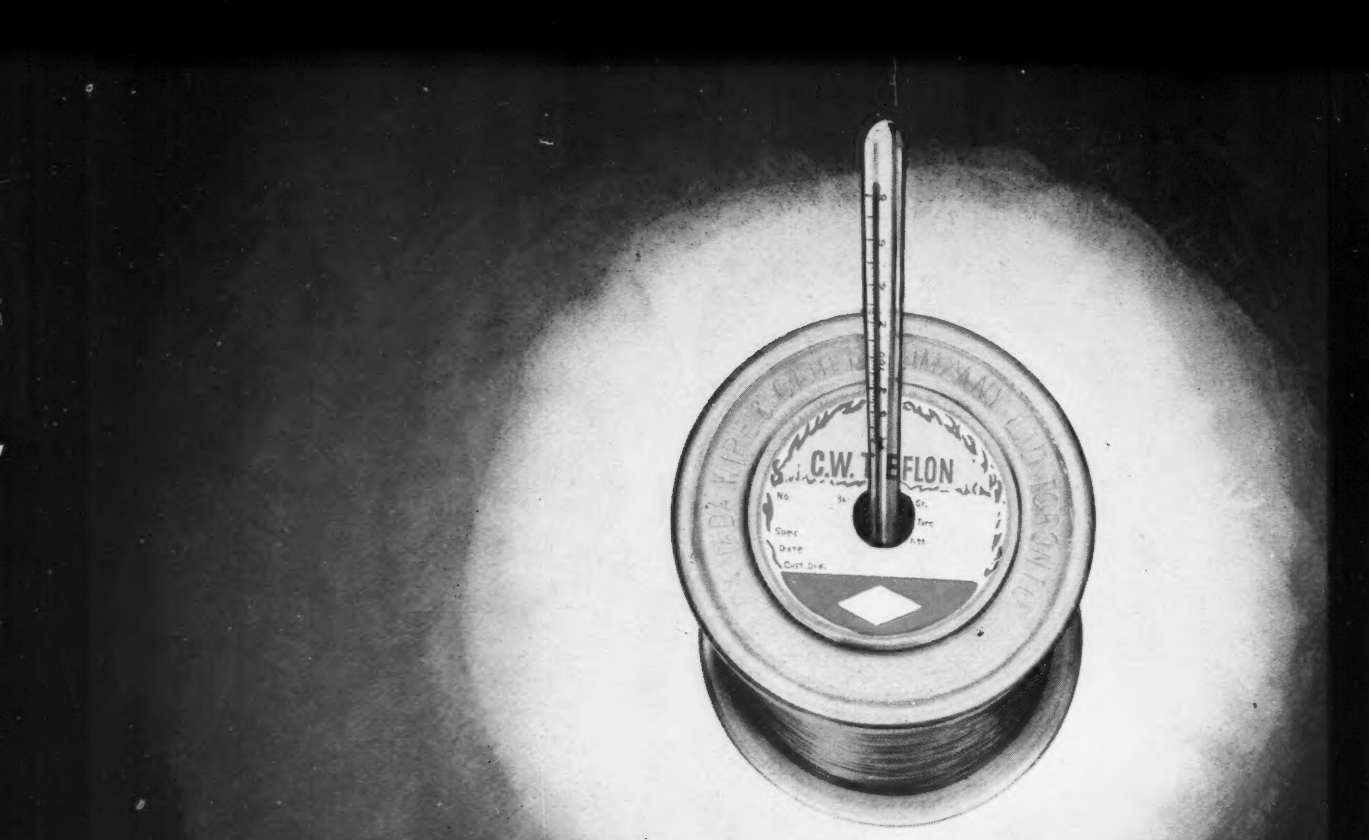

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Capable of continuous service at temperatures as high as 250°C.,

Canada Wire's Teflon insulated wires and cables break the heat barrier that has held up development of many projects . . . perhaps yours! Here are the facts:

- Teflon insulation available on magnet wires, lead-in and hook-up wires and power cables in a complete range of sizes.
- Meets all these specifications, where applicable: MIL-W-19583, MIL-W-16878B (Types E & EE), MIL-W-7139A.
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- It is inert to practically all chemicals and solvents. Unaffected by outdoor weathering or fungus. Extremely resistant to moisture absorption.
- Teflon insulation is non-flammable—has good arc-resistance and will not track.
- Produced with excellent dielectric characteristics over a wide range of temperatures and frequencies.
- Processed for increased abrasion resistant qualities.
- Multi-conductor cables available.
- Wires of all metals and alloys, such as Resistance, Thermocouples, etc. can be coated with Teflon.
- Available in solid colours and combination of braided tracers.

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Ceramic honeycomb shrugs off thermal shocks

New Cercor structures show high versatility

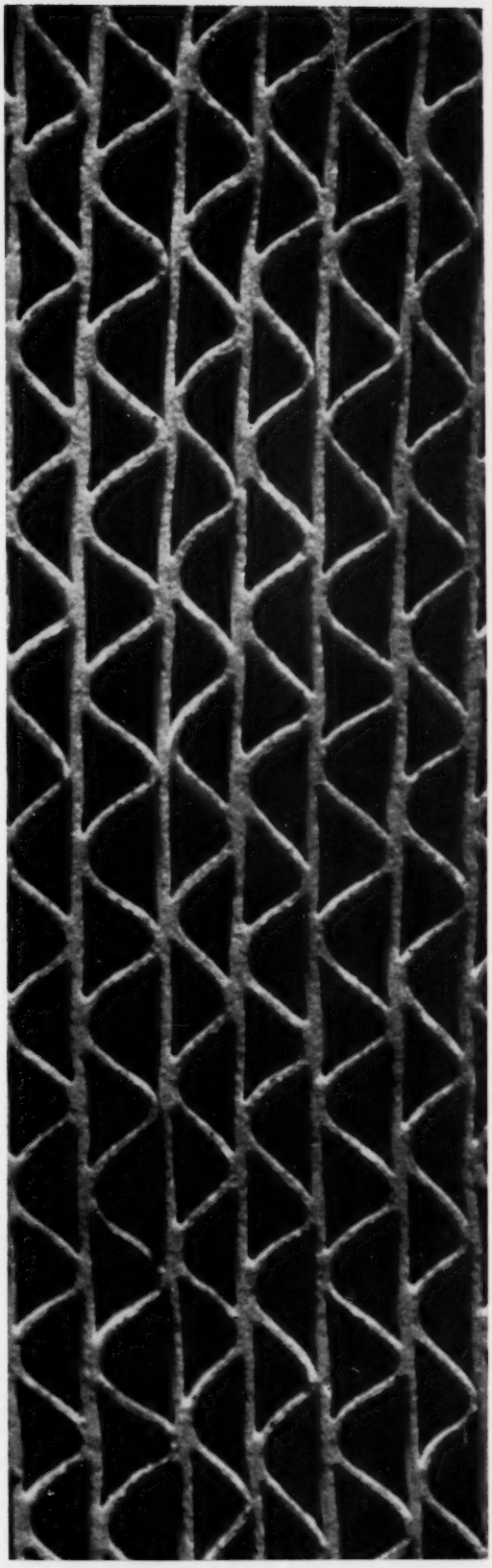
Extremely thin-walled ceramics, formed into lightweight honeycomb structures that can operate at high temperatures, have been introduced by Corning Glass Works.

These materials (made by the new Cercor process) can stand temperatures up to 1,800 F with virtually no thermal expansion, and can operate continuously at 1290 F. At these temperatures they are resistant to oxidation and corrosion. They can also withstand extreme thermal shock.

One characteristic is their extremely low coefficient of thermal expansion of 1 x 10-7 per deg C (from 0 to 300 C).

The extremely low expansion at high temperatures and the high surface area of Cercor-process materials indicate their future use in gaseous heat exchangers, as catalyst supports and as structural materials for use at high temperatures.

It is possible to build Cercor structures with a wide range of shapes and properties, and the base material can have a larger number of ceramic compositions. For example, Pyrocerum, a high strength crystalline material invented by Corning, is one of them.



Microphotograph of typical section is magnified 100 times to show close control of the wall.

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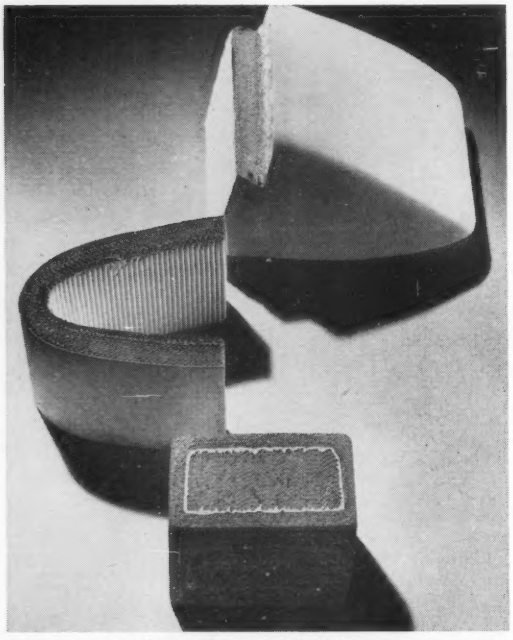


Cercor material can be shaped. Note strong ceramic rim in bottom photo, which protects thin-edged wall.

Disks 20 in. diameter and 3¾ in. thick have been made by the Cercor process. A protective rim for the disk is formed by a tough coating of special material with a matching expansion and an equally high resistance to temperature.

This rim can be applied to all sizes to protect the thin-edged walls against excessive outside stress. It can also be used as a convenient mounting support.

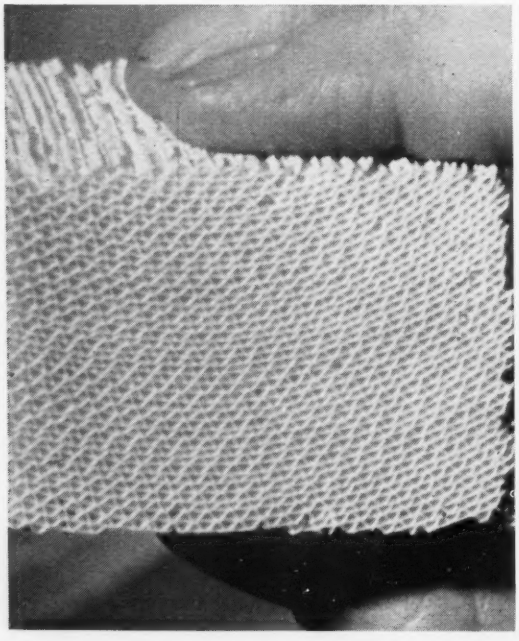
The new structures could also be used as air preheaters and after-coolers, as burner plates or covers, column packing material or in architectural design where lightness, thermal shock resistance and high temperature strength are required.

Available pieces have a compressive strength (parallel to the channels) of 2,000 psi. Surface area of the 20-hole-per-in. corrugated structures is 1,500 sq ft per cu ft of material.

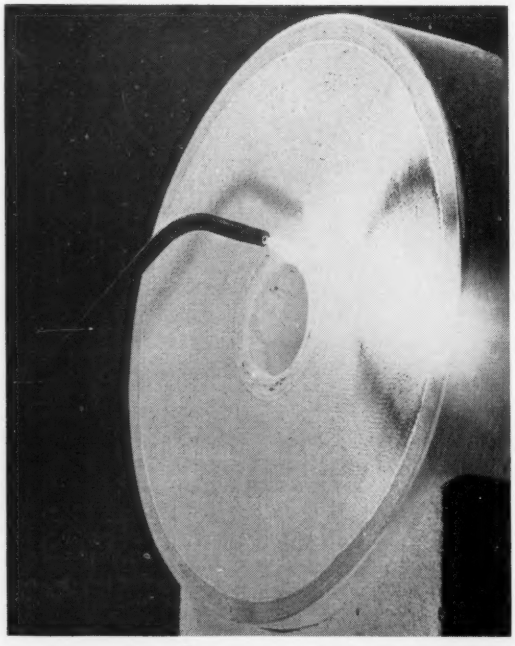
Of the total face area, about 75% is open space. Hole sizes of Cercor pieces are approximately 0.095 in. long and 0.045 in. high. It is believed that the cellular holes can be formed into a variety of shapes with a wide range of dimensions.

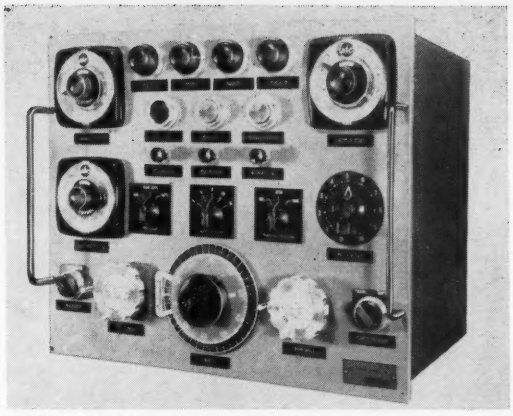
The material has a density of about 30 lb per cu ft and a specific heat (room temperature) of 0.20. Average wall thickness of the structure is 0.005 in. ★

The filling for a ceramic sandwich. Hole structure is corrugated, but other hole shapes are possible.



Material is designed to withstand high temperatures. Blowtorch applied to Cercor has no apparent effect.





Dials control the servos, which in turn control the tools.

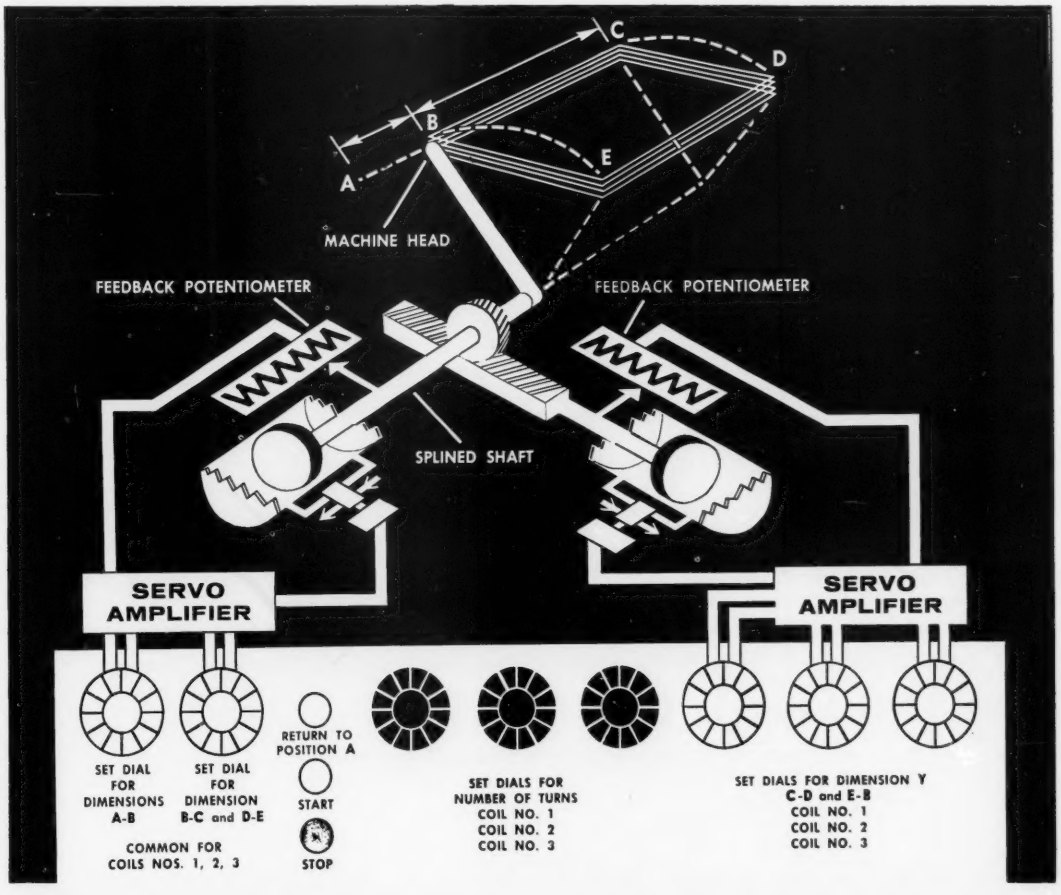
Point-to-point positioning

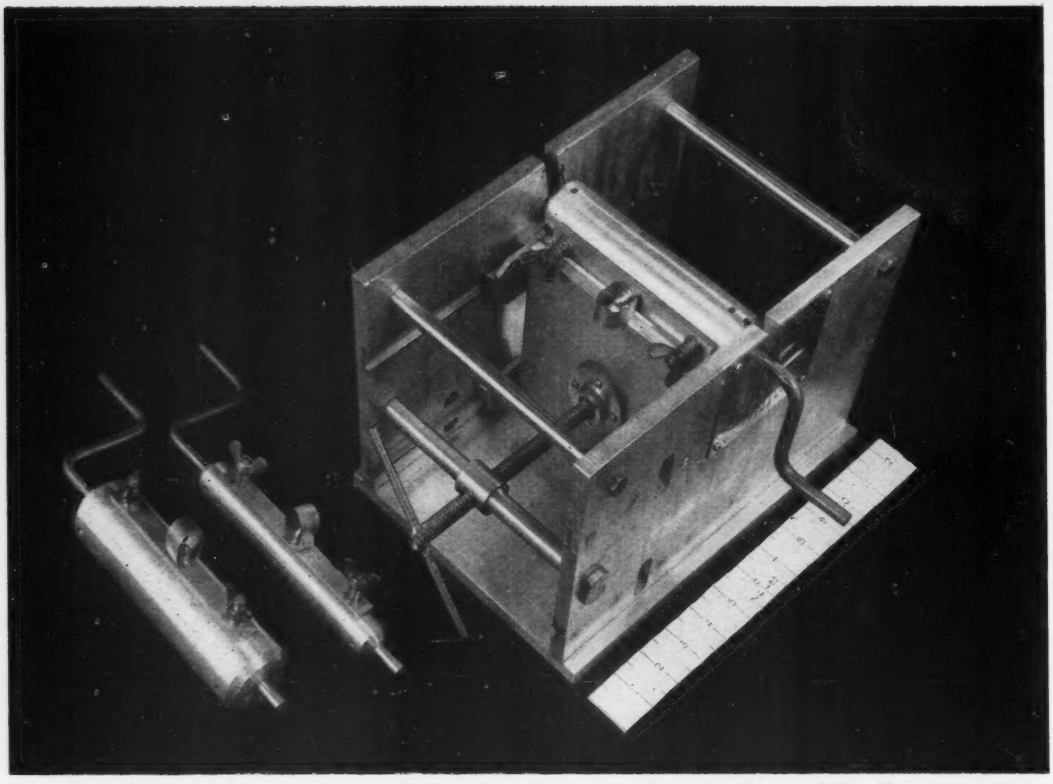
New system is developed for short-run production needing automating

A new automatic point-to-point positioning system with simple dial-set analog programming has been developed by CDC Control Services, Inc. Designed principally for automating short-run production (in such operations as punching, drilling or inserting) the system saves time when used for direct, uncoded programming for repetitive and symmetrical motion patterns. For example, a set-up involving five different dimensions and three different repeat commands can be programmed by setting eight adjustment dials. Changes in dimensions or sequence can be made by resetting the dials.

Positioning is accomplished by means of high-performance electro-hydraulic servo systems, capable of a positioning speed of 0.2 sec per basic motion, with a positioning accuracy of 1 in 1,000. Because a modulated (and not an on-off signal) is used, infinite adjustability is possible for longitudinal and transverse axis movements.

The CDC system is also available for random-instruction (non-repetitive) or contour programming. ★





Photograph shows flexibility tester assembled and ready for use. Two mandrels at left widen range of tests.

Flexibility tester allows comparisons

D. A. MacLeod and J. A. Wheat DEFENCE RESEARCH BOARD

Flexibility may refer to such properties as stiffness, brittleness, flexural strength, bendability or fatigue strength in bending. Usually, however, it is measured by one or more of the following properties: (a) Young's modulus of elasticity; (b) the force required to bend the material; (c) the life of the material on repeated flexing; and (d), the arc through which the material can be bent without cracking or breaking.

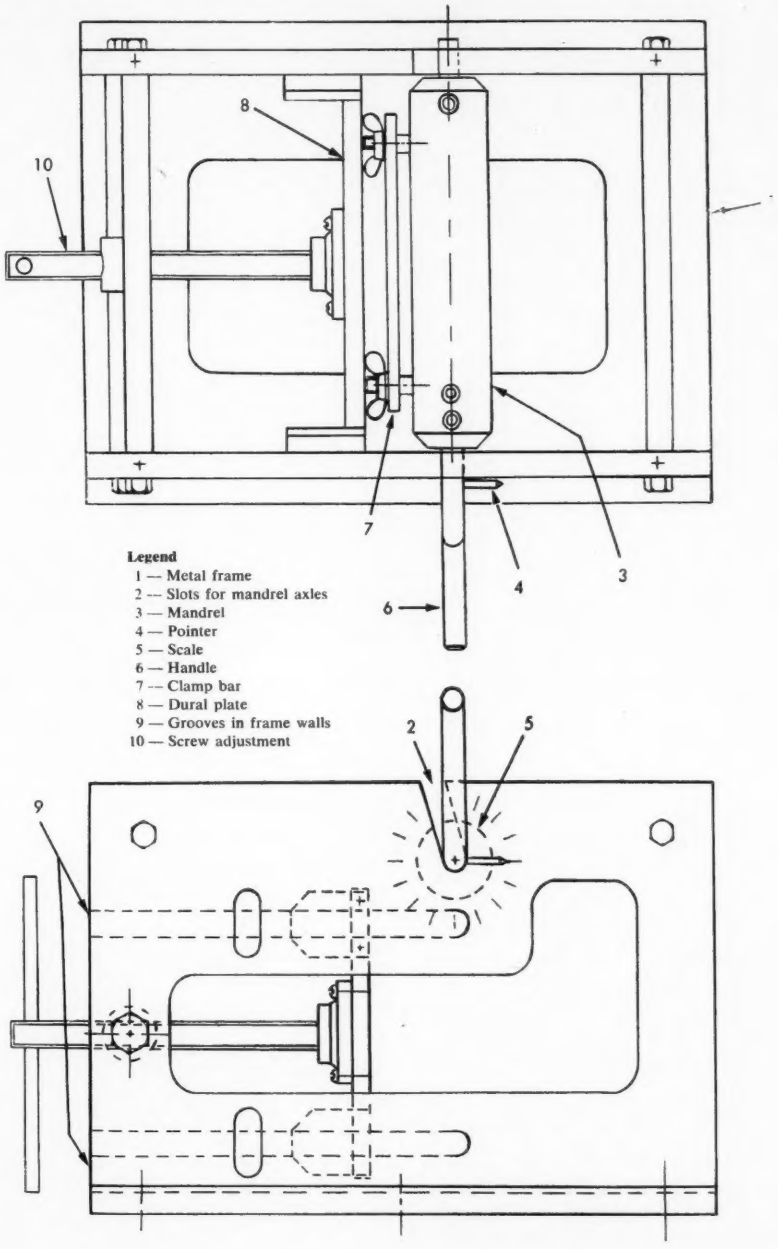
(a) may be determined by loading the centre of a simple beam of the material; (b) by measuring the force needed to bend a cantilever beam; (c) by applying a cyclic stress until failure occurs. Instruments for measuring these properties are commercially available. In (d) we have not been able to find a description of any apparatus that will give a quantitative value. There are specifications for roofing felts, linoleums, insulating products, injection molding compounds and gasket materials that involve the bending of samples around a specified radius, after which the material is accepted or rejected, as the case may be. These methods do not usually take into account such factors as rate of bending or pressure against the mandrel. In any case, they do not allow a comparison to be made.

We wished to compare the flexibilities of various formulations of a material about ¼ in. thick and so developed the apparatus described here. With it we are able to bend the material under controlled conditions and to denote the flexibility numerically.

The apparatus (Fig. 1) consists of a metal frame (1), with slots (2) cut in the walls to take the axles of the mandrels (3). Mandrels of 1, 1½ and 2 in. diameter are provided, but other sizes can be used. The mandrels are made from dural bar stock of appropriate diameter, with the ends turned down to serve as axles. To one of the axles is attached a pointer (4), which indicates on a scale (5) the angle through which the mandrel has been turned. A handle (6) is also provided on this axle for rotating the mandrel. A spring-loaded clamp-bar (7) along the length of the mandrel holds the sample. The dural plate (8), which serves as a sample guide, slides in grooves (9) in the frame walls and is positioned for the different mandrel sizes and material thicknesses by the screw (10).

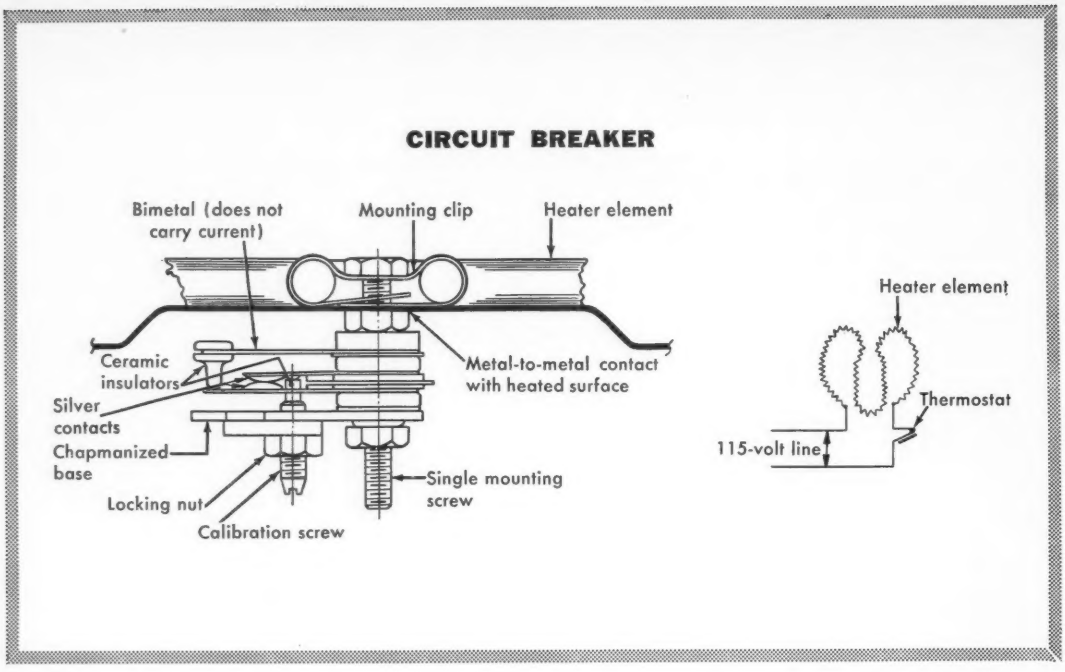
To use the apparatus, one end of a sample 2 in. wide by 5 in. long was clamped to the largest mandrel and the guide plate positioned so that it just touched the sample. The crank was turned slowly until the sample cracked. If it bent through 180 deg without cracking, it was placed on successively smaller mandrels until failure did occur. The flexibility was recorded by stating the angle of rotation and the diameter of the mandrel on which failure occurred. *(See drawings opposite)* ★

ASSEMBLY OF FLEXIBILITY TESTER



Legend

1 — Metal frame
2 — Slots for mandrel axles
3 — Mandrel
4 — Pointer
5 — Scale
6 — Handle
7 — Clamp bar
8 — Dural plate
9 — Grooves in frame walls
10 — Screw adjustment



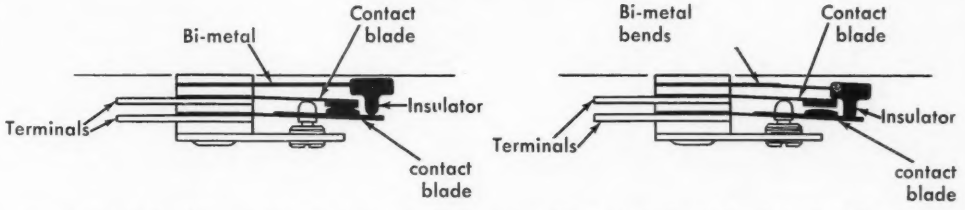
New thermostat —no manual re-set

Canadian Westinghouse kettle also features improved design, longer life with minimum servicing. But no change in the way water is boiled

New styling for the Canadian Westinghouse kettle is not marred by protruding reset button as it was on older models. Power is turned on/off automatically.

New thermostat is shown here enlarged twice actual size to illustrate its most important features. Compare it with old-style thermostat on the facing page.

MODE OF OPERATION



In view at left, the thermostat is shown at room temperature with the contacts closed. As heat reaches the bi-metal it bends downward, causing the insulator to push against the bottom contact blade which opens the contacts right. Friction and movement between insulator and bottom contact blade ensures positive action.

The design problem: when the old-model Westinghouse kettle boiled dry, the circuit was broken and required manual re-setting of the thermostat. The re-set button was unsuitable from a functional point of view; it protruded through the side of the kettle base, or was hidden on the bottom. In that case, kettles left near heated stove elements could be damaged when the re-set button was burned.

The old thermostat looked very much like a Rube Goldberg invention. It was operated by a bi-metal strip which, when heated, deflected away from a catch. When this happened, the circuit was broken. To reset the thermostat, the button (or plunger) had to be pushed back into the kettle to complete the circuit.

The new design: The new thermostat (made by Westinghouse) whilst only slightly more expensive, eliminates the need for any manual re-set. It turns power on and off automatically and has a life of 250,000 cycles. The unit is a compact one, with a constant spring pressure that makes it possible for the circuit to be completed automatically.

Additional advantages are that there is no need for a re-set button on the side (or the bottom) of the kettle, or for legs or a false bottom, if the re-set button is hidden underneath the appliance.

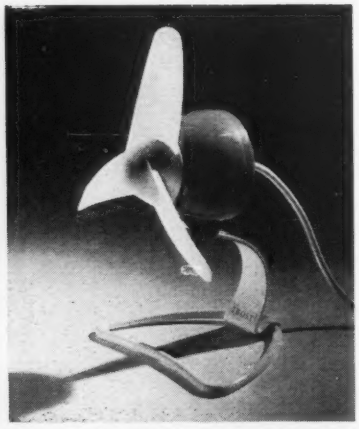
Equally important in the appliance design field, the new thermostat makes a more attractive kettle possible. Saleswise, it reduces service calls involving kettles that wouldn't work, not because they were actually faulty, but because the owner had not read the service book. ★

OLD—up-ended kettle shows the Rube Goldberg type of layout for the thermostat controls. To reset the thermostat it was necessary to push a button on underside.

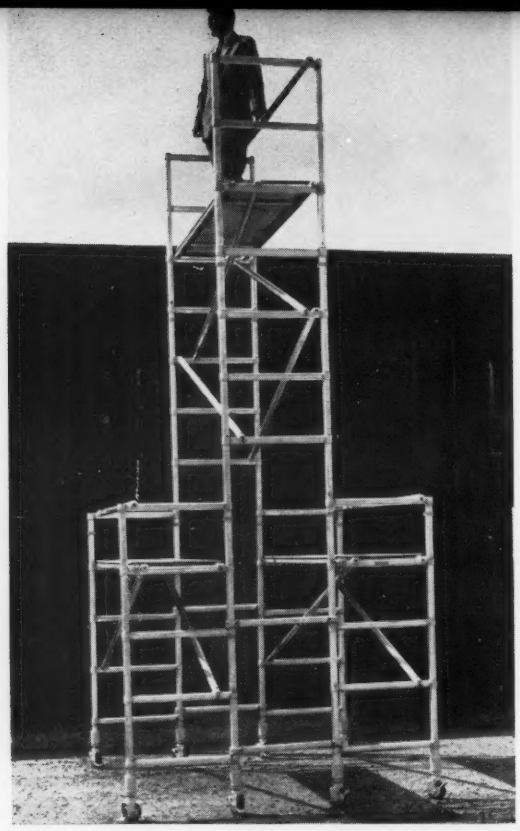
NEW—the thermostat assembly after it was cleaned up and relocated. False bottom hides mechanism and makes for better design. Servicing is reduced to a minimum.

Design news in pictures

Parts of gyro float for inertial navigation. Makers say it is first system successfully tested in U. S. (200)

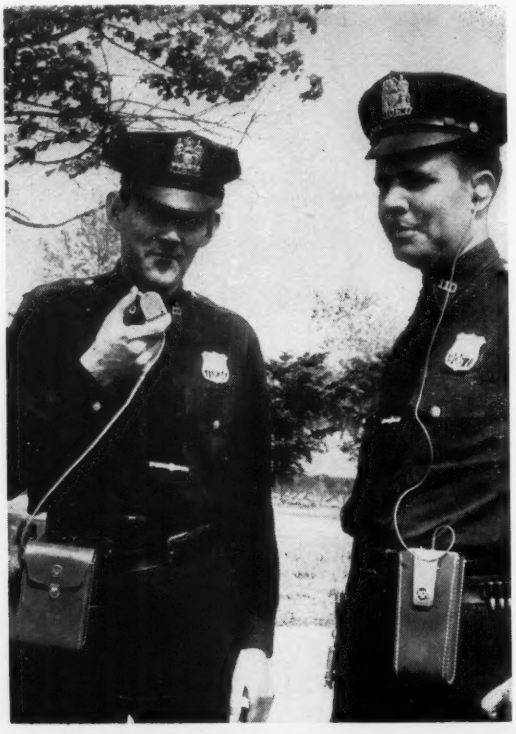


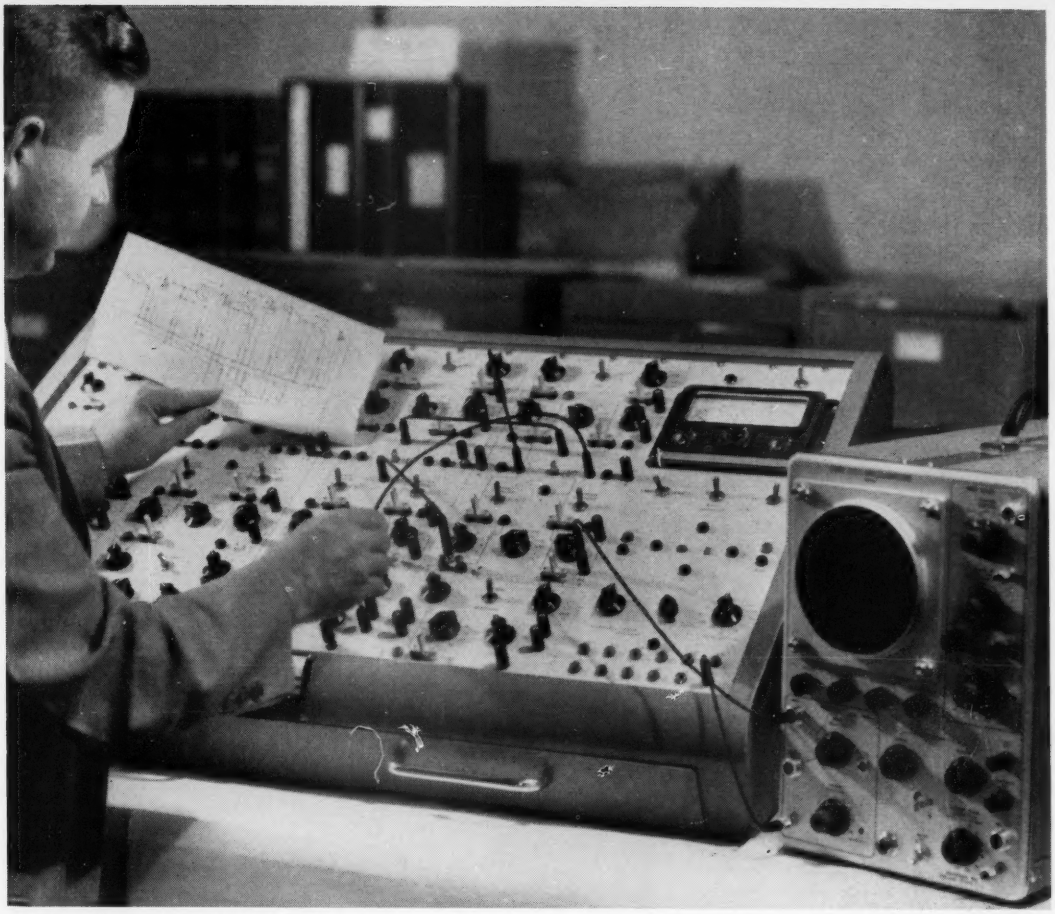
Personal fan is quiet and safe. Motor housing of die-cast zinc, steel wire base and polythene blade. (201)



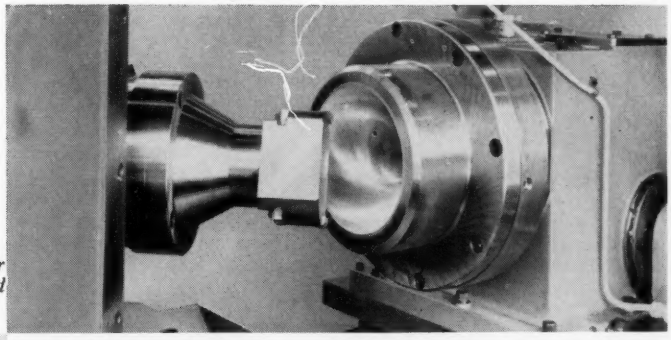
Aldek pyramid span scaffold assembly cuts on the job erection time by use of snap-locked braces. Casters feature instant leg adjustment up to 24 in. (202)

Miniature radio transmitter (left) and receiver (right) helps New York police fight crime. RCA product has many other obviously useful applications. (203)



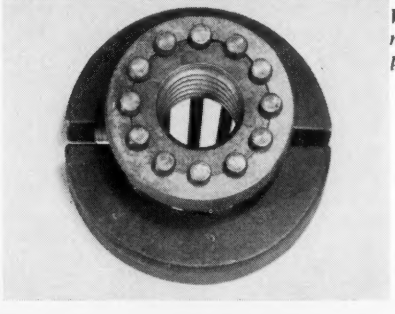


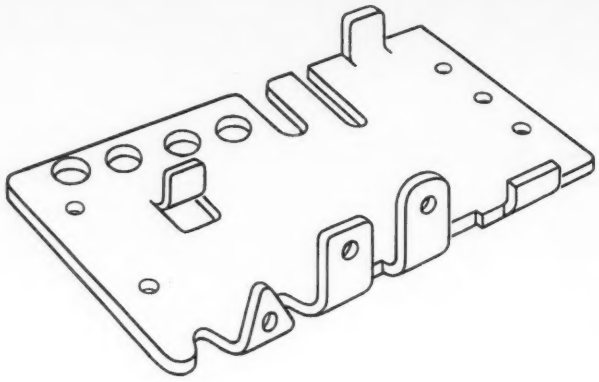
A new electronic unit developed recently, enables designers to check performance of circuit designs without "breadboard" of soldered wires. Very flexible, unit features curve tracer and master metering panel. (204)



Work spindle on this turning machine hogs out 15 cu. in. material per minute at ⅛ in. depth of cut. Unit performs on aluminum hemispheres from 6 to 16 in. diameter: is built to J.I.C. standards. (205)

Two-piece prestressed concrete anchor allows ¼-in. wire to be cold-headed in advance of installation. (206)





Hints on small lot stamping design

The short-run metal stamping shown above is used here to point out some rather common conditions that occur in the fabrication of such a part. The other diagrams are "alphabetically keyed" for reference.

The explanations given are general, for one sample cannot completely illustrate variations that might occur due to a difference in thickness, temper or type of material. This particular sample was made from 3/32-in. thick commercial quality, cold-rolled sheet steel, SAE 1010.

All this information was supplied by Dayton Rogers Manufacturing Company.

(K) This is a sharp corner as it comes out of the die for this thickness, temper and material.

Material that is thicker (or of lower shear strength) wil have more pull-down on the die side and may have more burr on the punch side.

Material that is thicker (or of higher shear strength) will have more breakage toward the punch side.

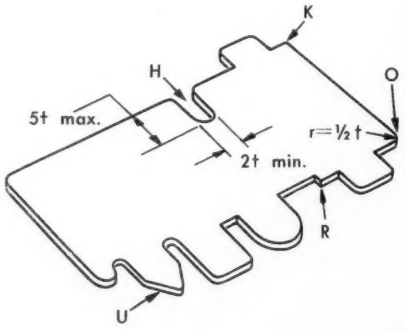
Corners can be sharp if the material thickness is 1/16 in. or less. Over 1/16 in., allow corner radii (r) equal to ½ the material thickness (t).

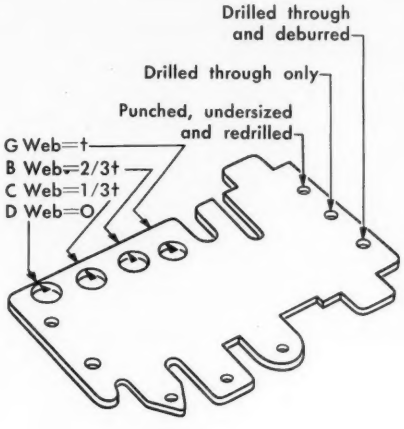
(O) This corner, with a radius equal to ½t, can be included in the blank at no additional cost for tools or operations.

(R) This is a slight step, with a sharp internal and external corner included in the contour of the blank. Pull-down on the die side and breakage on the burr side prevents better definition. Thickness, temper and type of materials will affect the results, as in (K).

(H) This notch is wide enough (for its length and material) to include in the blanking die. The blanking die cost would be a little higher, but still cheaper than a notching tool, with its extra operation.

(U) The same explanation as (H) applies to the two relief notches on either side of this form.





(G) The outside edge of the blank adjacent to this punched hole should not bulge, because the web (that is, the material between the edge of the hole and the outside contour of the blank) is equal to the material thickness (t).

In this case (web = 2/3 t) the edge of the blank will bulge slightly (measurable but hardly visible).

(C) Here the web = 1/3 t and the bulge is noticeable.

(D) With no web, the punched hole (which is tangential to the edge) will obviously break through.

(L) In this instance, the hole was punched undersize and redrilled to size without deburring, to show the small burr resulting from redrilling. This burr will occur on the drill side or, in this case, on the burr side of the blank. The drawing should clearly indicate what is required for the right price.

(M) Here, too, there is the same narrow web (= ½ t) but the hole was drilled through to avoid bulging. Drilling is, of course, much slower than punching and, in addition, there is a burr on the opposite side, which may or may not be objectionable.

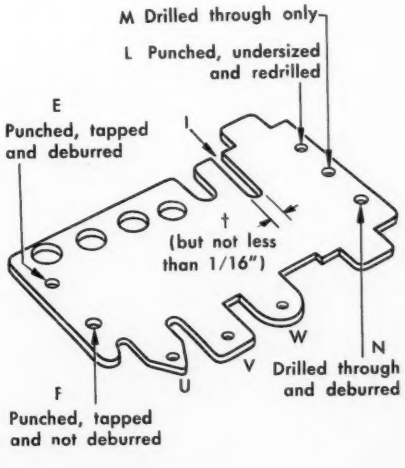
(N) As in (M), this hole was also drilled through, and in addition was deburred on the far side by lightly countersinking. Two operations are needed and either one is slower than punching, so the costs increase to several times the price of the punched holes in (G), (B), (C) and (D), or the punched and redrilled hole in (L).

(E) This No. 3 (medium fit) tapped hole was produced in three operations: punch, tap and remove burr. (For a No. 4 class fit, punch undersize, redrill to remove the breakage from punching, tap and remove burr.)

(F) This No. 3 (medium fit) tapped hole was produced in two operations: punch and tap. If the burr from the tapping is acceptable, the production cost will be lower than in (E).

Holes W, V and U were punched in the flat blank before forming, and are discussed later.

(I) This notch was too narrow and too long to include in the blank: it was therefore punched after blanking. It may require tools and an extra operation which will increase the cost in comparison to the adjacent notch (H), discussed earlier.



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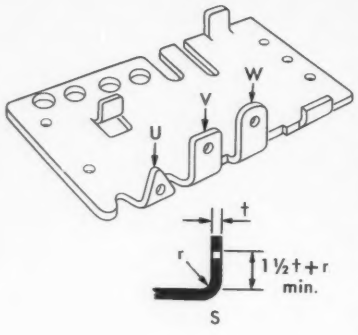


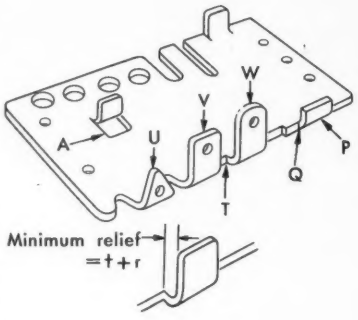
Referring to the three holes in the three forms:
(S) Illustrates a hole punched in the flat blank (W) far enough away from the bend that no distortion occurs during the forming operation. The inside dimension from the top of the main surface of the part to the edge of the hole should, in this case, be 1½ + r. Punching a hole before forming is cheaper than "after form," for both tooling and production.
(V) The hole in this form is also punched in the flat blank but closer to the bend. In this case, the distance from the top surface of the blank to the edge of the hole was only the equivalent of t + r and some distortion occurs in the hole. For some requirements, this distortion might be acceptable for economy reasons. If not, piercing "after form" will be required at additional expense for both tooling and production.
(U) In this case, the distance from the top surface of the blank to the edge of the hole is zero and considerable distortion occurs. If distortion is not acceptable, drilling may be the only solution and even this would be a problem, because the drill will form a burr on the inside of the form that may be difficult and expensive to remove.

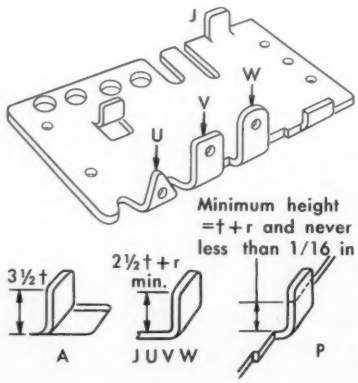
(J) This form is inside the blank contour by an amount t and without any bend relief. The fractures extend in from the outside contour of the blank, a distance t and just beyond the centre of the bend radius. If this portion of a part is under sufficient stress, fatigue can occur as a tear or fracture has already been started.

A similar situation occurs on the "shear and form" (A).

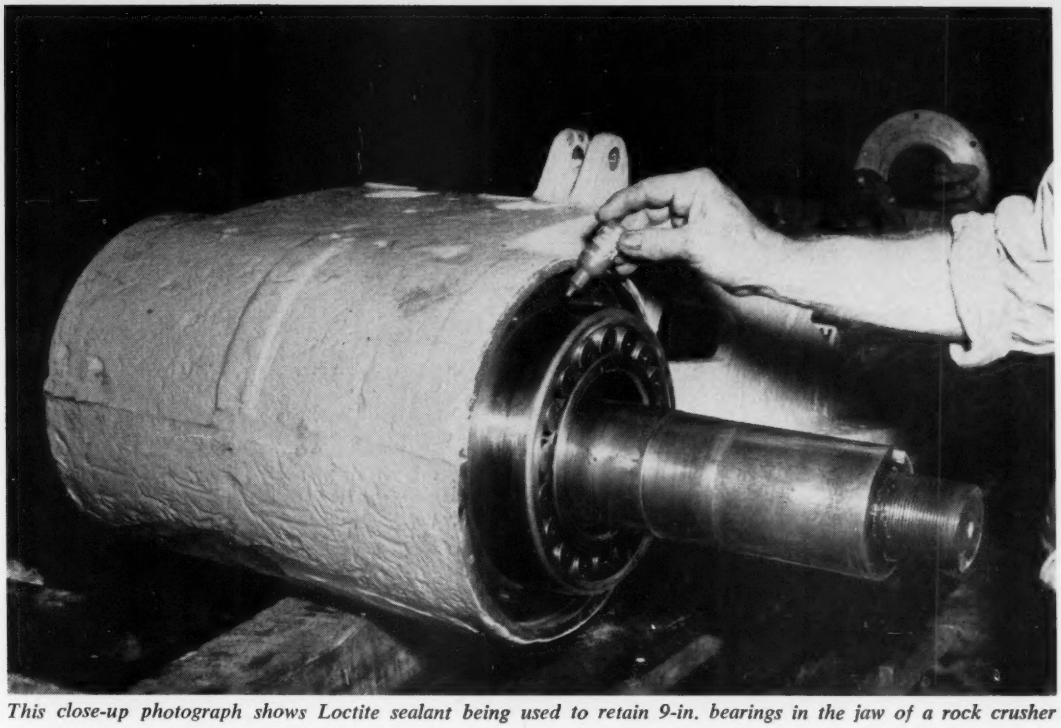
In addition, stock bending tools cannot be used and it is necessary to make special tools that will hold the main part of the blank flat during the forming operation. The tool cost will necessarily be increased. (In this instance, the two portions of the blank adjacent to the form are not held flat, for the sake of illustration.)
(P) This bend is just outside the blank contour by the thickness of stock, and the fracture extends just beyond the centre of the bend radius. Here, too, the same condition exists regarding failure under stress of this portion of a part.

(W), (V) and (U) have different relief conditions for the bends. The inset indicates that the minimum relief should equal t + r. This is an inside dimension, and the relief should preferably extend slightly beyond this minimum. The relief should also avoid sharp corners like (Q) and (T) in preference to the relief notches on either side of form (U).





Bends (J), (U), (V) and (W) are all high enough to form. The minimum inside height should be 2½t + r (see inset).
(P) This bend was not dimensioned high enough to form. It was therefore necessary to allow stock (as indicated above the dotted line) and cut off to size after the forming operation. When this double operation is necessary, the minimum inside height should equal t + r and never be less than 1/16 in. More expensive operations may otherwise be required.
(A) This is called a "shear and form" operation, and the inside height of the bend should be 3½t. This "rule-of-thumb" affects the size of the punch. The size (and consequently the strength of the punch) might be greatly affected by the thickness, temper and type of material for the part. ★



This close-up photograph shows Loctite sealant being used to retain 9-in. bearings in the jaw of a rock crusher

No press fit needed with this sealant

Remarkable new liquid Loctite makes a simple operation out of what was a costly, time-consuming repair — and takes rugged treatment

Loctite sealant is a thin liquid plastic that hardens only when confined between closely fitting metal parts.

Catalytic action of the metal surfaces, aided by the absence of air, causes the sealant to harden into a tough, heat and oil resistant bond. The joint is completely impregnated with solid plastic because Loctite hardens by polymerization rather than evaporation of a solvent and it is nonshrinking.

Its application is very widely diversified. As an example, a road machinery company replaced a 9-in. spherical roller bearing in the jaw of a rock crusher in less than an hour instead of the three to four days formerly required.

This was made possible by mounting the bearing with a slip fit and retaining it with Loctite sealant instead of the interference press fit previously used.

When this bearing was assembled with a press fit, it was first necessary to remove ¼-in. from the housing I.D. by a boring operation, then deposit a ⅜-in. thickness of weld metal on the exposed surface. Finally to rebore the housing to provide a .0015-in. interference fit between the bearing and the housing. In addition to the preparation of the housing, it took two men several hours to install the bearing.

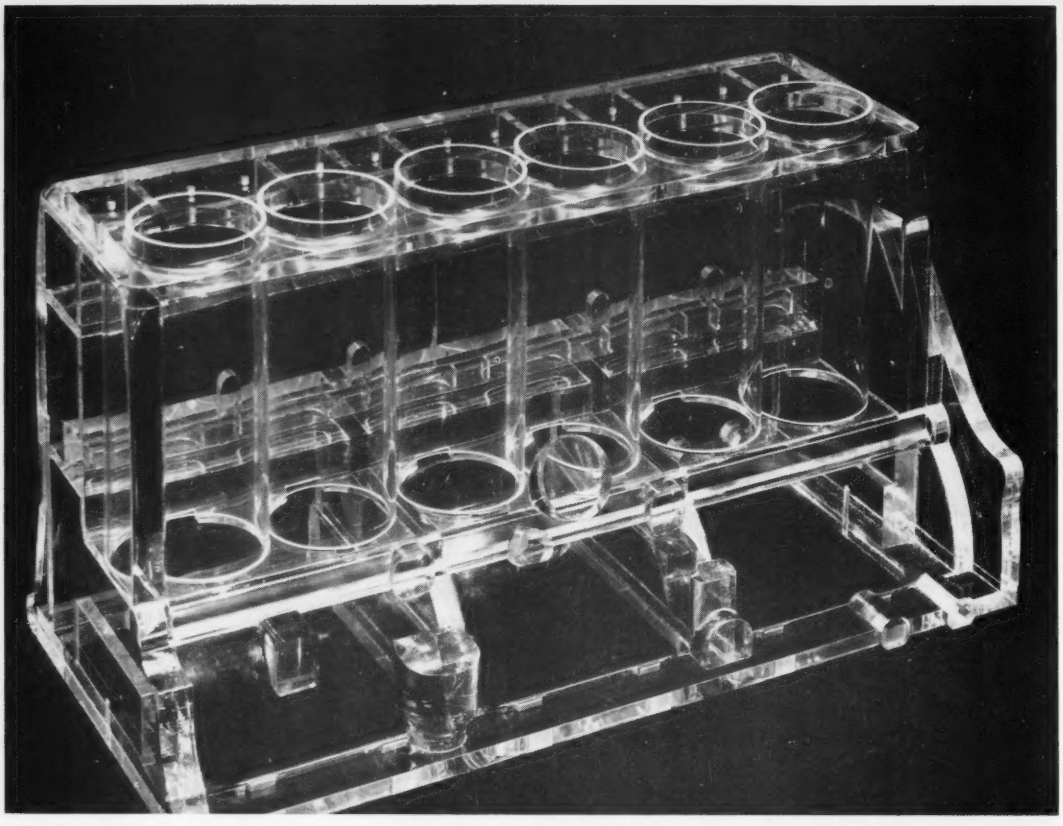
Now using the sealant, the complete job takes less than one hour. A clean rag is used to wipe the O.D. of the bearing and the I.D. of the housing — and the mating parts roughened with emery paper. Then Loctite Grade A is applied to both surfaces, and the bearing assembled with a light push fit (clearances are approximately .003-in.).

The sealant between the bearing and the housing starts to harden in 30 minutes and continues to harden on further standing. Complete hardening takes place in 12 hours at which time the bearing is gripped more securely than with a press fit.

These bearings undergo severe operational stresses. The crusher takes rock up to 10-in. thick by 20-in. wide and reduces it to pieces about 1-in. diameter. Each revolution of the eccentric shaft that drives the crusher jaw transmits a severe shock to the bearings. Units have been in the field for many months without report of failure, it is claimed.

The sealant can also be used in production to replace press fits, enabling user to relax tolerances and reduce rejects and rework. It was used to reclaim 4,000 aluminum castings that were bored 2½ mils oversize instead of for a .0005-in. interference fit. Bearings were mounted with Loctite and method used ever since.

In addition to its use on bearings, the sealant is used to lock nuts and bolts, to seal threaded sleeve joints against fluids under high pressure. Further uses include that of holding hardened sleeves to shaft and to mount bushings without need for a costly press fit. ★



This is a full-size transparent replica of a Plymouth motor block fabricated entirely of Plexiglas acrylic plastic.

Some optical properties of Plexiglas

The attractiveness and durability of Plexiglas acrylic moldings are due to the particular characteristics of the material. These are:

- Water-white transparency that gives depth and sparkle to back surface paints and metallized coatings. This crystal clarity also makes it possible to have a wide range of brilliant transparent, translucent or opaque colors to match color requirements with exceptional accuracy.
- Ability to withstand prolonged outdoor weathering.
- Good impact resistance; excellent resistance to discoloration and to most chemicals.
- Excellent dimensional stability. Like wood, metal and glass, Plexiglas has a tendency to expand and contract due to heat and humidity. It is however, always the same under the same conditions, and it does not shrink or swell with aging.
- Larger parts molded of Plexiglas require allowances for thermal expansion and contraction of the material in its mounting. This is important where the part is subject to a wide temperature range, as in out-door applications or while in transit. Appropriate clearances may be computed from the physical properties.
- Optical properties that make it well-suited to illuminated parts.
- Electrical properties that are very useful for applications requiring insulation.
- Ability to be molded accurately and economically into complex shapes.

Acrylic moldings have their characteristics and applications. This article deals with some of them

Refraction. A ray of light passing from air into Plexiglas (a denser medium) at any angle other than perpendicular to the surface will be refracted towards the normal. Similarly, when a ray emerges from the material into air (a less dense medium) it will be refracted away from the normal.

The angle α between the incident ray and the normal is the angle of incidence; the angle β between the refracted ray and the normal is the angle of refraction (see Fig. 1).

It is important to remember that these angles are always measured between the rays and the normal, and not between the rays and the plane of the interface. The relationship between the angle of incidence in air and the angle of refraction is stated in terms of the refractive index and is expressed as:—

$$\text{refractive index} = \frac{\sin \alpha}{\sin \beta}$$

For Plexiglas, this value is 1.489.

Reflection. If a ray of light strikes the material normally (at 90 deg), 96% passes through it into the Plexiglas and continues in a straight line virtually without loss of absorption, until it reaches the opposite parallel surface of the part, where 92% of the original emerges. In other words, 4% is lost at each interface by scattering.

As the angle of incidence increases, so does the amount of light lost by reflection at the interface. Fig. 2 shows, however, that this loss is less than 10% until the angle of incidence is greater than 60 deg (at point X on Fig. 2).

Internal reflection. A ray of light inside Plexiglas which hits a flat, polished surface in contact with air at an incident angle of 42.2 deg (the critical angle) or more (Fig. 3) will not pass through the interface, but will be internally reflected from the air-Plexiglas interface at an equal (and opposite) angle. If the angle is less than 42.2 deg, however, most of it will pass through and be refracted away from the normal in the air (the less dense medium). This will be clear from Fig. 4.

Total internal reflection is the basis for solving many functional light control problems. It can also be used to advantage to add sparkle and lustre to parts that are primarily decorative.

If the major surfaces of the Plexiglas part are parallel (or divergent), the internally reflected rays will be reflected back and forth from one surface to another until they hit a minor surface at an incident angle less than 42.2 deg, and so escape, as at point Z in Fig. 6. If the surfaces converge (Fig. 6), simple geometry indicates that the incident angle becomes progressively less. As it passes the critical angle, the light will pass through the interface. In certain instances, this may be used to advantage as a means of lighting instrument faces or to produce a halo effect around a speedometer pointer. It is known as "wedge-lighting."

Light may be piped around bends in rods, bars or curved plates, as shown on Fig. 7. Note that in (a), the minimum external radius of curvature is three times the thickness of the light piping part. This method is most useful where a random distribution of light in the part is desirable (as in some radio dials) or where a "cold light" (or remote spot light) is wanted, as in a medical throat lamp. System (b) differs from (a) in that it provides a direct line of sight through a single part or assembly by internal reflection from a few carefully designed air interfaces. This system is useful for concentrating the light within a narrow angle, as at the end of a speedometer pointer.

Remember that total internal reflection occurs only at an air-Plexiglas interface. If any material is in intimate contact with the part (so that there is not an air interface), light will be absorbed or diffusely reflected by the coating, and the light piping efficiency reduced. If the design (or function) calls for a coating, vacuum-deposited aluminum or white paint should be used, followed by the appropriate styling color.

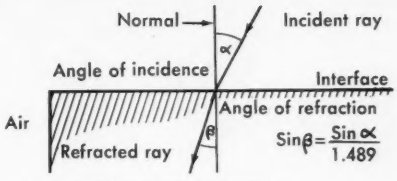
Parts molded of Plexiglas can be fastened to adjacent components by the standard methods used to attach similar metal parts. However, when there is need for transparency (as in many cases), it is necessary to use a method that will conceal the fastening.

Through fastening is one of the simplest ways of securing Plexiglas parts (Fig. 8).

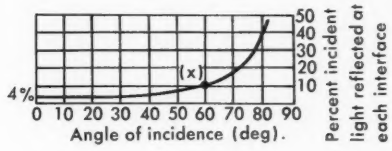
For maximum strength, mounting holes should be farther away from the edge of a molding than the thickness of the Plexiglas piece, to allow the material to flow around the pin in the mold.

The depth of a molded hole should not be more than twice the diameter of the hole. This will give sufficient

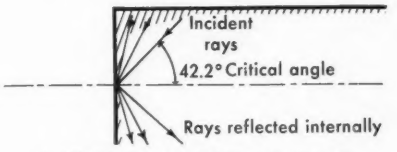
Optical properties



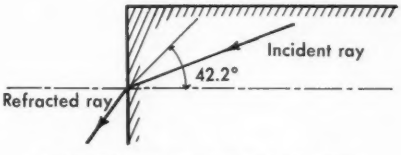
1. Shows how a ray is refracted.



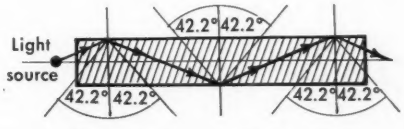
2. Loss due to reflection.



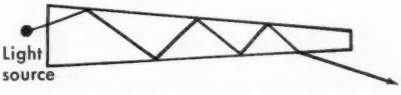
3. Critical angle of incidence is 42.2 deg. For this and greater angles of incidence, incident rays will be reflected internally.



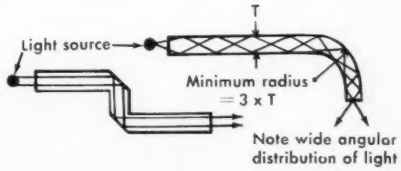
4. For incidence less than 42.2 deg. internal ray will refract as it passes into air.



5. Major surfaces are parallel. Rays are reflected back and forth from one surface to another when angles of incidence are greater than 42.2 deg.



6. If the principal surfaces converge, the incident angle is reduced at each reflection by the size of the angle between the surfaces. When the incident angle exceeds 42.2 deg. the ray escapes.



7. Total light transmitted at left is less than at right but brightness at the designed viewing angle is greater.

continued ▶

Plexiglas fastenings

rigidity in the core pins. Small holes (1/16th in. diameter or less) should not be deeper than the diameter of the hole, for the same reason. Deeper holes can be molded, if it is possible to support the core pins in both sides of the mold. Very deep holes are usually located by molded indentations followed by drilling through the part after molding. Always use pan-head or fillister head screws or rivets. Flat head or countersunk fasteners will cause wedge splitting when tightened and should be avoided.

Bosses are used to reinforce the edges of holes or for mounting an assembly. They should be small and located preferably near the corners, with a height no more than twice the boss diameter.

Lugs. Mounting rims or lugs should be used only when absolutely necessary and never where vandalism is a problem. They should be at least half the thickness of the molding, as long (and numerous) as possible (or preferably continuous) in order to distribute the load. Where the lug adjoins the part, use generous radii and fillets for good molding and maximum strength.

Lugs should be filleted into the body of the molding to avoid sharp corners.

Studs may be molded integrally with the part when aligned with the flow of the material around the insert. Allowance should be made for the difference between the co-efficient of expansion for metal and Plexiglas, by slotting elongated holes in the metal part.

Make the insert short and sturdy enough not to be broken, bent or dislodged by the flow of material. The depth should not be more than twice the diameter.

Shoulders of inserts should either project above the surface of the plastic or be at least flush with it. A narrow lip of plastic between a threaded insert and a bolt, for example, is subjected to high stresses when the bolt is tightened. (See Fig. 9).

Molded threads incorporated in the molded Plexiglas part can save assembly time, but may increase the cost of the mold. If this increase is not justified by a saving in assembly, it is practical to machine threads in the moldings. Mold a pilot hole as a guide to the tapping die.

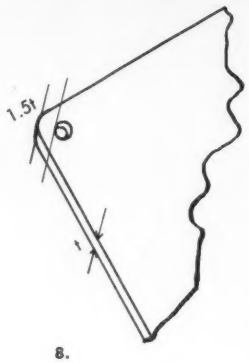
"Molded in" threads should be coarse and heavy with rounded grooves, to reduce the danger of cracking. Do not start the thread at the surface of the molding. Allow at least 1/32 in. to eliminate a feather edge (Fig. 10).

It is not practical to mold threads into the part for hole diameters less than ¼ in.

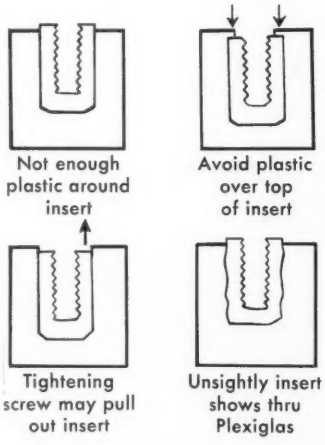
If the part is frequently to be taken down, use metal inserts.

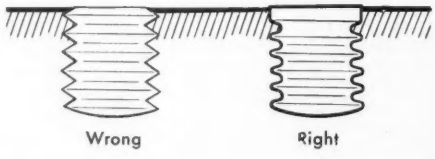
Thread-cutting screws (such as Shakeproof type 25) are used on tail-lights and shoe heels. Care must be taken to avoid stressing the Plexiglas.

Integral bezels (Fig. 11) can be molded as part of the Plexiglas piece to simplify assembly, where the part is mounted behind (and projects through) a die-cut hole in the surrounding material or where through-fasteners are used.



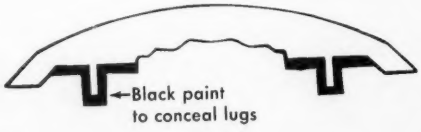
8.


Not enough plastic around insert
Avoid plastic over top of insert
Tightening screw may pull out insert
Unsightly insert shows thru Plexiglas
9.



10.

11.



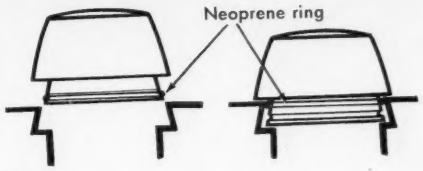
12.

Concealed fastenings are important in some designs. Most of the methods of attachment have been evolved from die casting practice. But when designing for a transparent material, ingenious ways to conceal the fasteners must be found. There are as many solutions as there are conditions to be met.

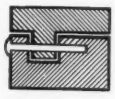
Two typical ones are shown in Fig. 12 and 13. If the attachment section (Fig. 12) is placed in an area of very dark-colored second-surface decoration, it becomes invisible. Fig. 13 uses a flexible ring gasket on a reverse tapered section. It is not pilfer-proof but well-suited for its use as a horn ring ornament. The neoprene ring rolls up and wedges the button in place.

Hinges. The simplest is the lug and pin hinge (Fig. 14). For spring closure the Rathbun or Geissel (Fig. 15) can be used.

Latches. The friction latch calls for an undercut, molded or machined (Fig. 16). The spring clip latch goes in like the Geissel hinge with forced teeth (Fig. 17) ★



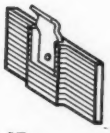
13.



14.

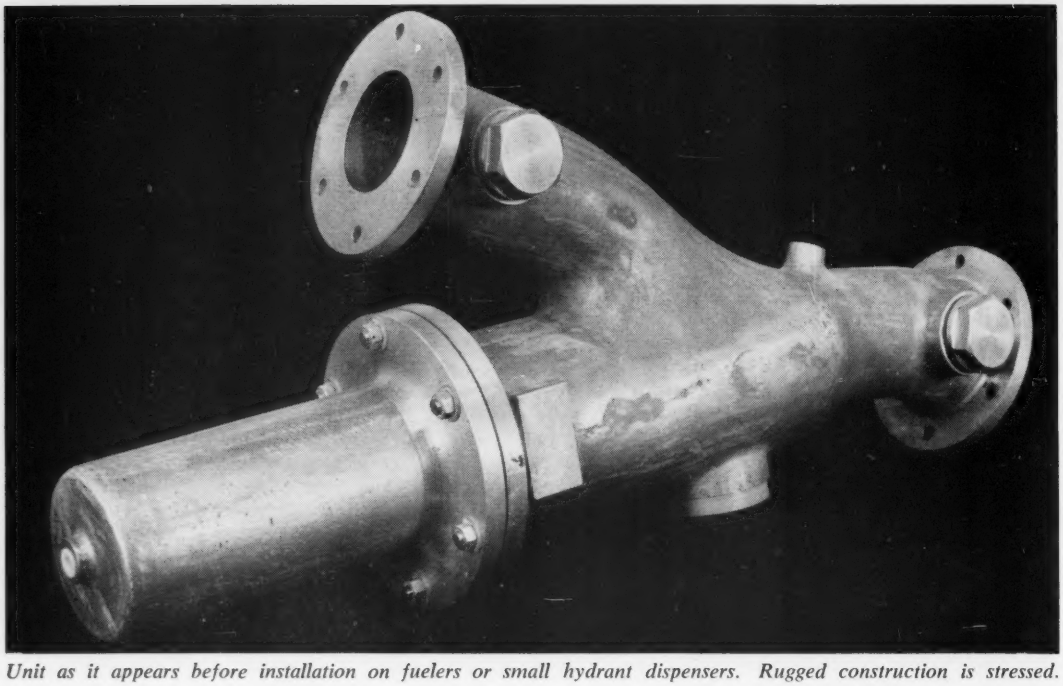
15.

16.



17.

A survival compass cover made of molded Plexiglas. 3.75-in. wide, cover has .06-in. walls and molded-in threads.



Unit as it appears before installation on fuelers or small hydrant dispensers. Rugged construction is stressed.

Aviation fuel monitor boasts own pilot

Its job is to strafe gasoline imperfections with deadly accuracy

Aircraft fuel must reach the tanks "on specification" as regards physical properties and must also meet the requirement that it "shall be clear and free from water, sediment and suspended matter."

The need was therefore felt for a monitoring device that would be fully "fail-safe" and be situated as near to the end of the fueling system as possible. The fuel monitor designed by the Shell Petroleum Company meets this requirement and is in no way intended as a substitute for any other piece of airfield equipment or safety checks at present carried out.

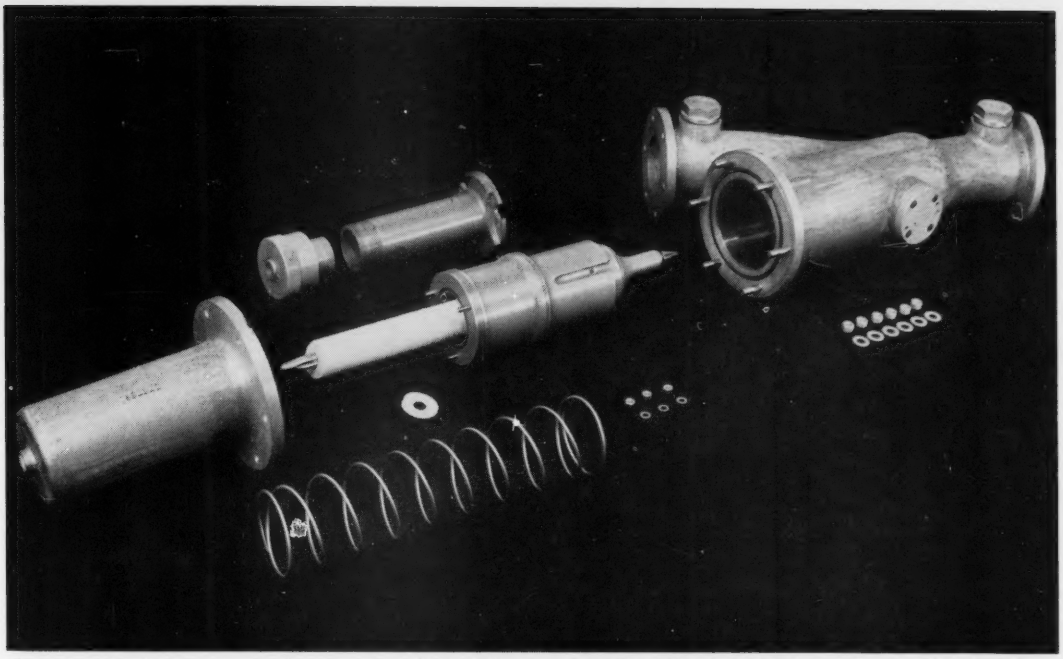
The monitor consists of a valve and sensitive element, the latter being so constructed that it will cause the main valve to close when contaminated fuel passes through it. During normal operations with "dry" fuel, the valve will open and close as the delivery valve is opened and closed, so that it is repeatedly exercised, and any risk of its becoming "frozen" in the open position is eliminated. It is also constructed so that faulty maintenance (such as failure to replace the element) will prevent the valve from opening. The element itself is robust, and casual handling cannot cause damage. The complete unit can be easily installed on fuelers or small hydrant dispensers.

The way it works is described in fig 1, while the valve is shown in figs 2 and 3. Actual flow through the piston is directed by suitable ports to the inside of the element; in the simplified diagram of fig 1, the flow is shown from outside to inside. After flowing through the element the sample stream emerges through the pilot valve and piston hose. The pilot valve is spring-loaded onto the pack and closes by expansion of the element and differential pressure arising from the resistance to flow through the element when water is present. This feature means that the valve will also shut if there is excessive particle contamination causing clogging of the element.

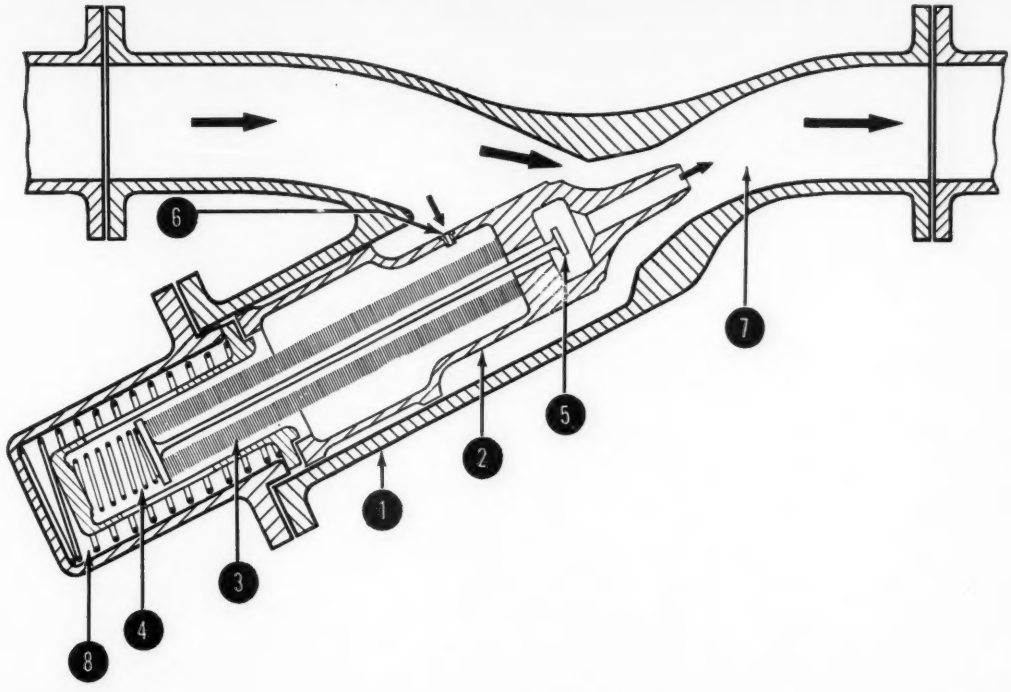
As the valve is intended as a final check on the fuel, it is important to locate it so that contamination cannot take place between it and the aircraft tanks. For this reason, the unit has been designed for installation equipment between micro-filter and delivery hose.

The over-all closure time of the valve varies with the degree of water contamination; the greater the contamination, the faster the valve will shut. With very small water concentrations it is possible that some contaminated fuel may reach the aircraft tanks (before the fueling system automatically shuts down) because the quantity of fuel which has passed the monitor will have exceeded the capacity of the pipe up to the aircraft connection. Whenever the valve closes, it is a clear warning that fuel contamination has occurred. Aircraft and fueling equipment must then be checked at every point and remedial action taken.

Calibration tests of the valve show that only at very low throughputs (less than 200 gal) could the sensitivity of the valve be considered as marginal. (Further development work is now proceeding to improve this characteristic.) At the same time, a number of units suitable for flow rates up to 200 gpm are under construction for extensive field trials. Part of this operation is directed toward finding the "life" of the element under service conditions. A 500 gpm unit is also under development to meet the fueling requirements of future aircraft. ★



Components of the unit can be seen at a glance (above) while (below) principle of operation is clearly defined.



HOW IT WORKS

Above is a simplified diagram of the principle of operation. The unit has a flanged casting with a lateral branch (1) in which is located a piston member (2). Inside the piston is a spring-loaded sensitive element (3) and (4) to which is attached a small pilot valve (5). In the wall of the piston is a restrictor orifice (6) through which a sample of the main flow passes. The nose of the piston member extends into the venturi-shaped throat (7).

The fuel sample passing through the restrictor orifice also passes through the element, which will expand if the fuel is contaminated with water. When the system delivery valve is opened, the pressure downstream of the piston member is reduced, thus causing a similar reduction in the pressure inside the piston member. The higher upstream pressure reacting on the differential area between the major and minor diameters of the piston member then causes the valve to open. At the same time, the higher upstream pressure allows a sample of the flow to pass successively through the restrictor orifice, the sensitive element and the pilot valve. It is then discharged via the nose extension into the region of the venturi throat. The size of the restrictor orifice governs the pressure at which the valve will open and the percentage of the main flow taken in the sample. The lower pressure in the venturi throat assists in drawing the sample through the restrictor orifice and element, while the diffuser section provides pressure recovery and reduces the pressure loss over the complete valve.

The four-inch stick with weighted knob is the "control centre" of General Motors new Unicontrol system.

Meet tomorrow's electronic chauffeur

Ways and means of bypassing the hurly-burly of much of today's driving conditions are getting top attention from automotive research. High on the list are automatic controls.

But no matter how advanced the control system is that substitutes for the driver, it must not conflict with the advantages now held by manually operated vehicles. These advantages of convenience, flexibility and comfort are highly prized by today's driver—and automatically controlled cars must maintain or enhance this group of benefits.

These and many other interesting findings were unearthed by General Motors research staff when making tests with experimental vehicles. Conclusion: while an electronic chauffeur may drive your car of the future, right now human drivers can do a better job.

For test purposes, two different types of experimental vehicle were designed. One (the Unicontrol car) is steered, accelerated and braked by a single stick control. Left and right motion of the 4 in. weighted knob steers the car. Forward motion accelerates it and pulling the stick backwards applies the brakes.

The other car is steered automatically by an electrical or magnetic path produced by a cable in the pavement. Tuned pick-up coils in the car's front bumper feed in voltage variations to an electric computer, which gives command signals to the vehicle's modified power-steering unit.

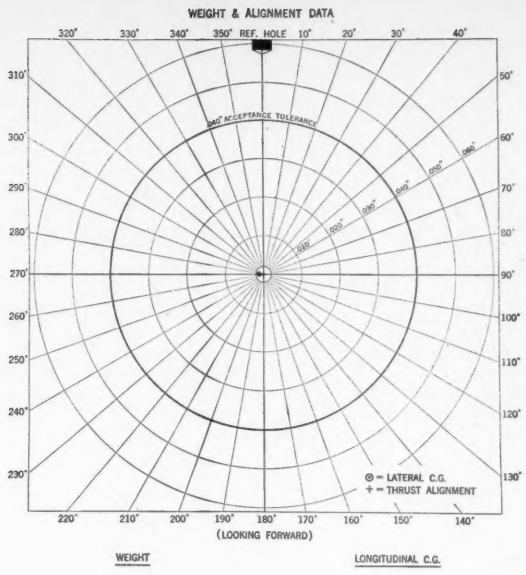
Specifications for completely automatic control systems indicate that equipment will be needed both on the road and in the car. For example, it will be possible to provide guidance with elements such as rails in the road without any equipment in the car. Conversely, the vehicle could be guided by some photo-electric scanning system. This would detect the road position of the car in the same way that the driver does now.

With such a guidance system, no equipment is necessary on the road. But the most practical method will involve some road equipment, as well as some in the car. Like providing vehicle guidance by using a magnetic path (a current-bearing wire in the road), with a suitable sensing means and a steering system.

Urban driving poses one of the biggest problems for automatic control of vehicles. For this, cars will need some very complicated decision-making equipment to perform a completely automatic control. Probably the most feasible application of automatic control will be on limited access highways which might handle manually and automatically controlled cars. If practical, this might tee-off a vogue for the lease of automatic equipment on "automatic" highways.

Thus it will be unnecessary for all vehicles to carry complete equipment. Instead, vehicles using the automatic road will be able to utilize its performance by renting the required additonal equipment.

Altogether, these predictions mean that future long-distance motoring merely involves switching on James the electronic chauffeur. It's just a step farther to enjoying armchair comfort and tv in the family buggy. And you can count us in for all this luxury living. ★



An automatic device for testing guided missiles is superior to the mechanical methods previously used

Aircraft missile weight and balance

An automatic device for testing Falcon guided missiles is so accurate that results on a production line basis are better than the mechanical methods previously used.

The device (the only one of its kind in the U. S.) is known as an aircraft missile weight and balancing system. It was designed and built by the Electronics and Instrumentation Division of the Baldwin-Lima-Hamilton Corporation.

The equipment, which accurately determines the centre of gravity (cg) and thrust alignment of the missile, consists of two major units: an instrument console and a missile platform. The equipment does these things automatically:—

- Measures the weight of a missile to an accuracy of 0.1016.
- Finds the longitudinal cg to an accuracy of 0.015 in.
- Determines the lateral cg to an accuracy of 0.002 in.
- Measures the thrust alignment to an accuracy of 0.002 in.
- Repeats measurements on the same missile to an accuracy of 0.0005 in.

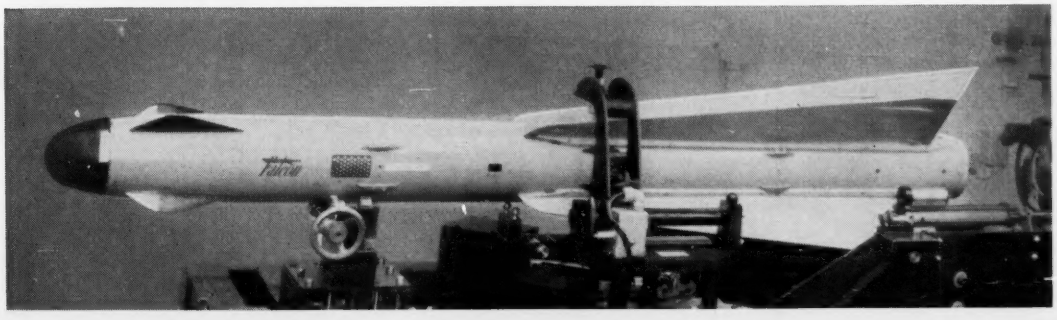
The longitudinal cg is recorded in inches on the lower right corner of the chart (above), whilst the lateral cg is (for recording purposes) symbolized on the chart as a circle around a dot. For the missile to be acceptable, the cross must be within the tolerance circle on the chart. The point at which the lines of longitudinal and lateral cg intersect is the missile's true centre of gravity. Theoretically, this is the point at which the whole mass of the object can be balanced.

Thrust alignment is the operation of lining up of the missile's lateral cg closely. Before they had the new equipment, Hughes used mechanical means to determine the cg and thrust alignment.

The new equipment provides the first system that can measure the cg thrust alignment directly.

The quality control instrument for testing the Falcon missile was made possible through the use of two specially designed SR-4 sensing elements and one standard SR-4 load cell. The SR-4 elements and cell (strategically located in the missile stand) enable the instrument to plot the missile's characteristics at the rate of one missile every five minutes. ★

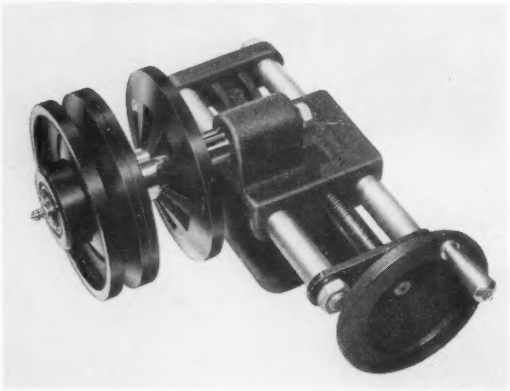
The Falcon guided missile is shown on the weighing and measuring stand. Test will take only five minutes.



Ideas round-up

Variable speed pulley: small adjustment gives wide speed range

A wide range of speeds can now be obtained from almost any ½ hp or 1 hp constant-speed motor, by means of a variable speed pulley mounted on an adjustable control base. The pulley is a double variable pitch unit, which automatically adjusts driver and driven sheave belt speeds, according to its distance from the motor. Moving the countershaft towards the driver reduces driven speed; movement away from the driver increases the driven speed. A small adjustment makes the complete speed range available.



The High Ratio Pulley (as it is known) is supplied in two models. The fractional to ½ hp unit has a ratio of 6/1 with a PD varying from 1.875 to 4.60. The fractional to 1 hp unit has a 7.2/1 ratio with a PD from 2.40 to 6.50. This makes both models extremely versatile.

The faces of the pulley are made from tough plastic with special additives, for long life, economical replacement and low maintenance. The pulley assembly is needle-bearing mounted on a hardened and ground countershaft and a simple handwheel adjustment gives precise settings on the control base.

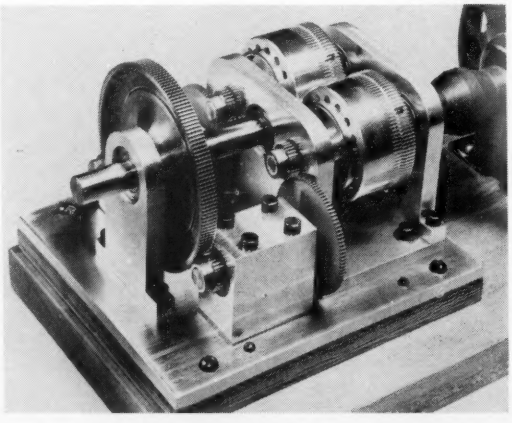
The entire unit is light, sturdy and compact. It can be installed in many different drive configurations. (207)

Zero backlash bi-directional actuator: quiescent current helps

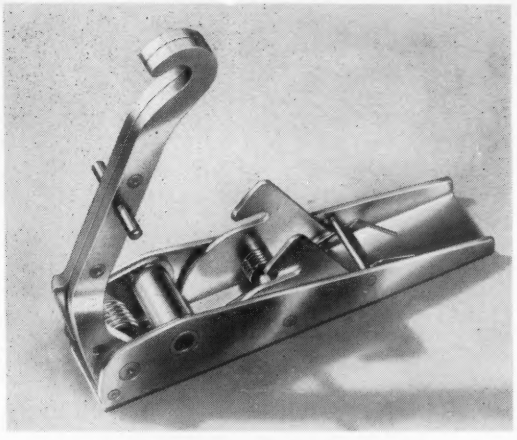
The mechanical arrangement of a typical zero backlash bi-directional actuator is shown. Zero backlash output is achieved without precise gearing and is not dependent on exquisite mounting and tooth forms or finish. No spring-loaded gears are employed.

The motor drives continuously in one direction of rotation, coupled to the input shaft of one hysteresis clutch geared to another rotating on a parallel axis. Thus the clutch driving or input members are rotating in opposite directions. The two low inertia clutch output members are geared to a common shaft through a parallel gear train. When one clutch is engaged, output and input coupled, one side of the output train is directly coupled to the motor output. By switching to the other clutch, the opposite direction of rotation is achieved, for the first clutch serves as an idler gear between the motor shaft and the second clutch input member. In this way, by switching from one clutch to the other, bi-directional output at the common shaft is achieved. Zero backlash is accomplished by permitting a low order of quiescent current to be impressed on the clutch coil of that clutch not carrying the load, to produce a drag on the opposite side of the gear train from that carrying the load. This action establishes tooth pressure and takes up bearing tolerances so that, when switching occurs and a new direction of rotation is started, there is no lash in the new direction of rotation.

Interesting applications of these actuators are: gyro gimbal torquers on the Falcon missile; as a tracking antenna actuator in the La Crosse ground guidance system, scanning antenna drive on the APS-42; navigational radar. (208)



Flush lock: beryllium copper used for radome latch



Specifications prepared by an aircraft manufacturer called for a completely non-magnetic, high-strength flush latch which matched in physical size existing stock latches. Hartwell Aviation Supply Co. used beryllium copper in this radome latch, because aluminum (and similar light metals) would have been too bulky in design to meet the 1,000 lb static tensile strength requirement. Latches of beryllium copper have been tested to 1,230 lb before bending.

Because of the danger of galvanic action between dissimilar metals, the beryllium copper is plated with cadmium. Beryllium copper is one of the strongest non-magnetic alloys available. Its corrosion resistance is also important in this application.

Prior to receiving the manufacturer's specifications for this latch, Hartwell had very little experience with beryllium copper. They had used it only in flat leaf springs, to replace carbon steels that developed a hydrogen embrittlement factor. Although beryllium copper was considered hard to work, they found that the alloy could be run on the same punch dies previously used to make Type 302 annealed stainless steel latches. The only problem was a tendency on the part of the cold rolled metal to crack in forming the extremely sharp radii required for a flush fit with the aircraft skin. However, by using annealed stock, it was possible to produce as small a radius as on stainless steel, with few rejects. The firm uses Berlyco No. 25 beryllium copper strip (annealed temper) from the Beryllium corp. (209)

Powder metallurgy: closer tolerances in brake hub design

Design engineers at Chisholm-Moore were faced with particularly critical problems in designing the electrically operated "lodestar" chain hoist. They had to put together an extremely small power "package" (rugged enough to withstand the shocks of rapid starting and stopping) to bring a full load from rest to a speed of 32 fpm (for the ¼-ton model) and then braking to zero speed, with maximum safety.

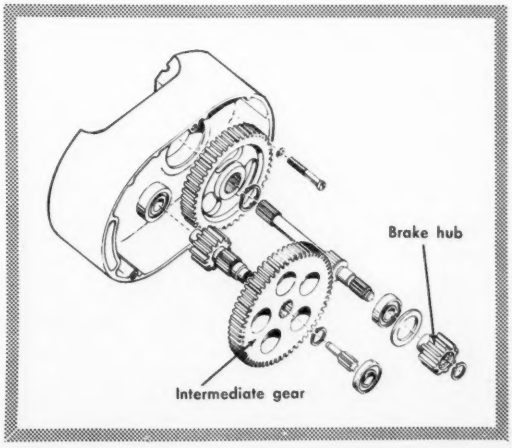
A key component in the braking system is the powder metallurgy brake hub, which is part of the drive shaft and pinion sub-assembly. In this design, friction disks in the electric brake assembly are splined to the hub, which in turn is splined to the drive shaft to form a direct connection to the motor shaft.

Formerly, this part was machined from bar stock. Changing the design to a powder metallurgy part saved about 70 cents a part. Closer tolerances, better surface finish and improved mechanical properties also resulted from the change.

Now made of iron powder, the hub is subjected to substantial shock loads. After pressing from iron powder, the material is copper infiltrated, so that the final part has the following composition: 15-25% CU; 70-84% FE; 0.6-1% combined C. The alloy corresponds to SAE Type 7, with a density of 7.1 to 7.6.

Another essential component in the gear train is the intermediate gear, which must have the mechanical strength necessary to transmit power from the motor to the lift wheel smoothly and quietly.

It is pressed and sintered from an iron powder blend containing 7% copper, conforming to specifications for SAE Type 5. Because of the importance of this component, its dimensions must be produced to close tolerances. Tolerances on the diameter of 4.563 in. are ± 0.005 in. The run out of the pitch circle on the gear is 0.004 in. TIR maximum. As for the splines, the diametral pitch is 32/64 and the pressure angle 30 deg. Critical gear data include a diametral pitch of 14 and a nominal pressure angle of 20 deg from the normal plane. (210)



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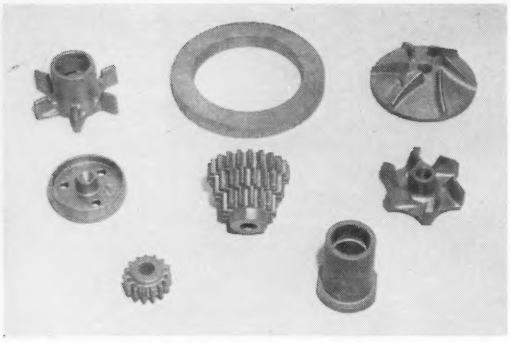
CO_2 process castings: secret is in the sand mix



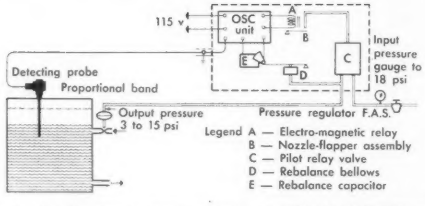
Swayne, Robinson & Co. announce the development of a process for producing molds for gray iron castings by CO_2 molding method. (A method explained in DE, April 58.) The method is particularly suited for castings designed to eliminate machining costs.

Key to success in the process: a proper sand mix. Many tests were made to determine the proper balance of sand, binder and release agent to produce castings with exceptional fidelity of detail.

Gassing of the mold is generally more efficient and economical than the shell method of baking, since the molds are cured in the cold state. There is also less chance of dimensional change due to uneven cooling in sections of varying thickness. (211)

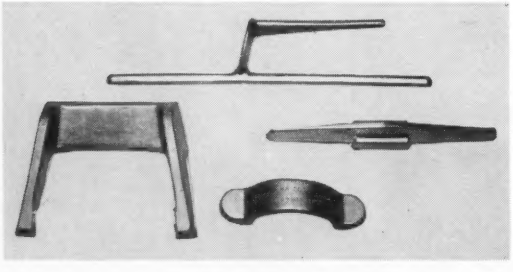
Pneutronic level control: system for liquids and granular media

Consisting of a capacitance sensitive probe and a controller, the Pneutronic level controller (Robertshaw-Fulton Controls Company) is a complete system for level control in a wide variety of liquids and granular media through precise pneumatic pressure output. Claimed to be particularly valuable for use in vessels (or small tanks) that do not permit the internal installation of conventional systems requiring large detection devices, the new control system is obtainable with weather - tight or explosion - proof control housings. Types are available for either overload or underload control. The device can be used with hydrocarbons, oils, acids, aqueous solutions and many granular products. (212)



Shown is the Pneutronic level control unit (Model 111) with an air-to-close control valve located on the input line of a typical vessel. Assume the control system is at balance. If the product is consumed at a higher rate, the level at the detecting probe will drop. This level change is detected by the bridge circuit in the oscillator unit as a decrease in capacitance. The current through the electromagnetic relay A is decreased, (as a result of the capacitance decrease) and this permits the flapper B to move away from the nozzle.

Forged tools: aluminum hand tools can take severe abuse



A product development program to increase the use of aluminum forgings for hand tools has been started by Harvey Aluminum. Directed at the industrial designer, design engineer and materials specifier, the project furnishes manufacturers with application studies and metallurgical data.

In reviewing reports made by field servicemen to tool manufacturers, it was found that a frequent complaint was the failure of cast aluminum handles and parts to withstand ordinary on-the-job abuse.

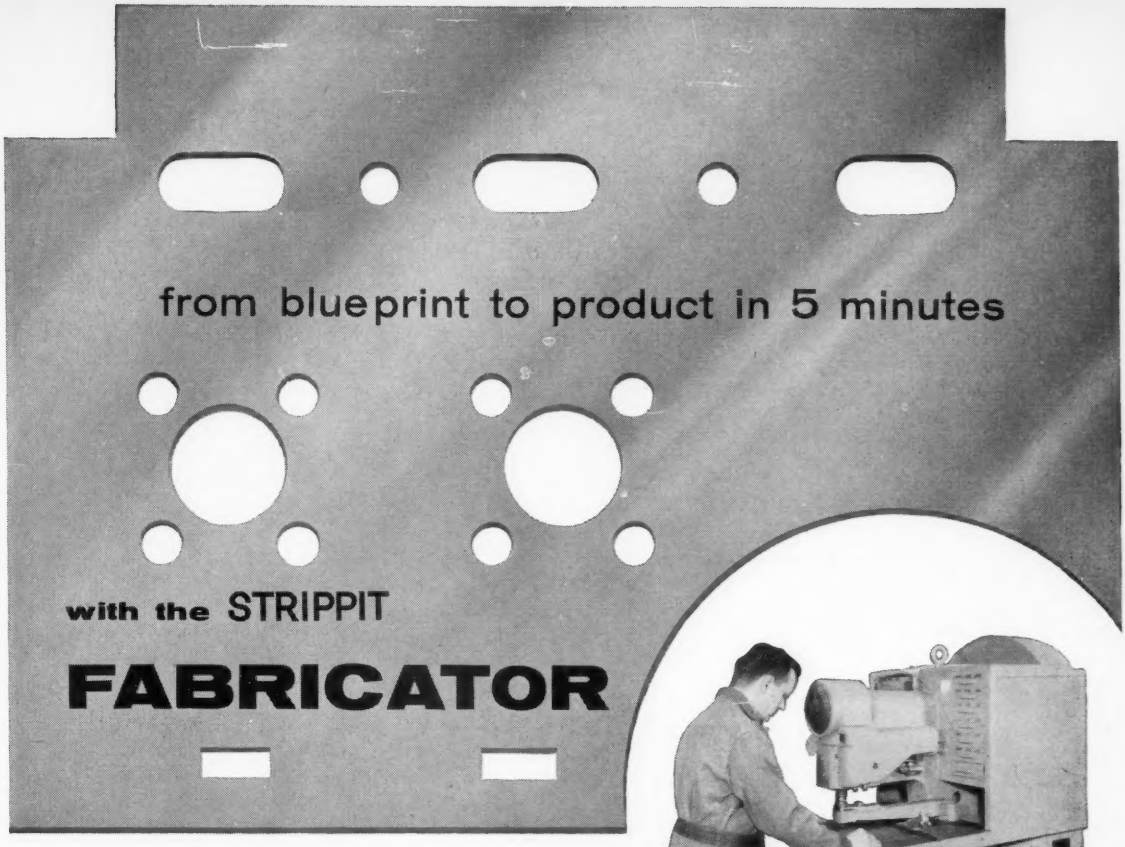
Hand tools are not, of course, a new application for aluminum forgings: what is new is the special type of aluminum forging for use in quality lines of hand tools.

The first phase of the program concerns press forged handles for trowels, spray guns, drills, power hammers and similar implements.

Aluminum forgings (unlike castings of that material) are almost unbreakable and can be subjected to severe working conditions.

As a result, optimism design is realized and weight reduced. With a lighter part, operator fatigue is less and hand tool effectiveness increased.

Examples of these aluminum forgings are:—(top) trowel handle; (left) lift handle for large drill; (centre right) switch handle for portable power generator; (bottom right) safety bar for pneumatic hammer. (213)



Short run? Complicated pattern? If it's sheet metal up to ¼" mild steel, if it's punching, notching or nibbling, it's profitable on a Strippit Fabricator!

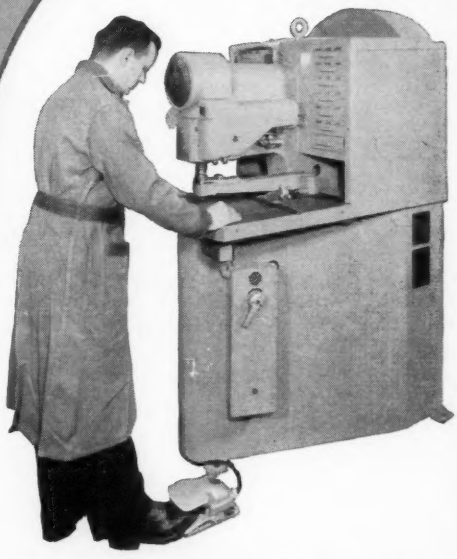
Set up in minutes! Punches and dies are changed in 30 seconds or less, and Strippit guided punches need no aligning or adjusting. Back stop with precision gauge is instantly set by a locking knob. Self-tripping finger stops on gauge bars provide multiple stopping as the work is moved rapidly under the punch. A switch gives you single punching or 165-stroke-a-minute nibbling, and all tools are within quick reach in attached "file drawers" or shelves. The Fabricator is more than a one-machine shop — it's a whole system of quick-change, high-profit fabrication used by thousands of shops.

What's more, you can add the Strippit Positive Duplicator for high-speed punching in medium runs — plus the Dupl-O-Scope to punch Duplicator templates right from the drawing, in a few minutes. Write today for details and demonstration at your plant by the Strippit mobile unit.

Special tools made up to your specifications.

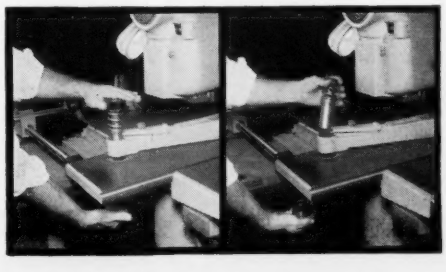
STRIPPIT
TOOL & MACHINE LIMITED
Formerly Wales Strippit of Canada, Ltd.
103 Research Rd., P.O. Box 688, Brampton, Ontario

A UNIT OF HOUDAILLE INDUSTRIES INC.



THE STRIPPIT FABRICATOR—a single compact multi-purpose Punch Press with quick-change tool holder, quick-set gauging and stops.

BELOW, TOOL HOLDER is pulled out, for instant removal of die and punch assembly, ready for the next interchangeable tool. 1¼" diameter capacity holder shown, 3½" diameter holder also available.



Ball bearings: split design has integral shield

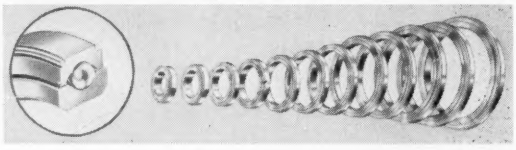
Integral shields are featured in new high-precision instrument ball bearings manufactured by Split Ballbearing Division of MPB, Inc.

These Type TWF bearins are of thin-section design, made in twelve sizes with bores ranging from 5/8 to 3 1/16 in. The integral shield feature is possible only with the patented split ball bearing design. Integral shields are formed by extending the lands of the inner and outer rings to within a few thousandths of an inch of each other. The resulting close-clearance annulus fills with lubricant, to function as an effective seal without the friction of contact seals.

The ball races in these bearings are of the deep-groove type, with continuous shoulders. No filling slots are employed, so full use of the thrust capacity of the bearing can be made. Because a full ball complement is used, the bearings offer the maximum radial and two-directional thrust possible in a radial ball bearing of its dimensions. The closely spaced balls make the bearing ideal for applications where high static capacity is required, or where there is oscillating movement.

A companion series (Type TWA) is also available in the same sizes. They are similar to Type TWF, except that alternate balls are undersized to act as separators for the load-carrying balls and to reduce the torque in the bearing.

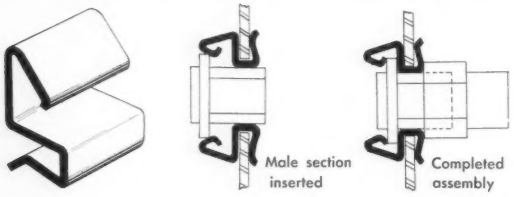
The new TWF and TWA lines complement existing types TCF, TCA and TCR to form a group called the "T" Series, a complete line of high-precision, thin-section instrument ball bearings for the design engineer. (214)



Speed clips: vibration-proof fastening without tools

Designed for through-panel application of solderless multiple-connector electrical terminals; a speed clip announced by Dominion Fasteners Ltd.

Assembly of the clips and terminal unit is a simple operation that requires no tools, nuts, bolts, screws or other auxiliary fastening devices. Moreover, these new spring steel clips retain themselves firmly when fastened.



A pair of the fasteners are first snapped onto the panel. The male section of the terminal connector is then inserted into the rectangular panel hole, and, as it passes through, the spring legs of the clips compress and spring out again over the flanges projecting from each side of the connector. These flanges prevent the connector from passing completely through the panel and the clip prevents it from being pushed out when the other half of the connector is applied. The connector is removed merely by compressing the spring legs with a pair of pliers.

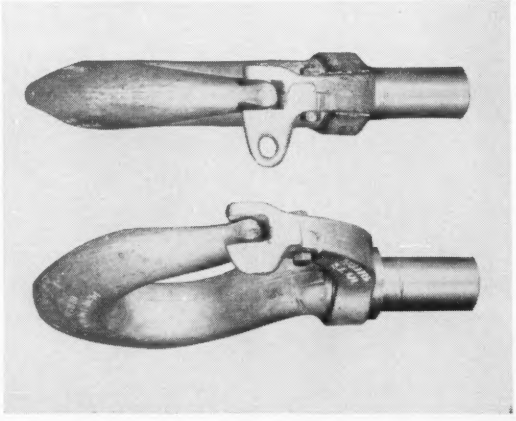
The clips provide an extremely fast, vibration-proof fastening. (215)

Hoist hook: safety gate gets locking mechanism

A new locking mechanism for the Bullard safety hoist hook gate has been developed for use on large hoist hooks. This mechanism locks the safety gate in place over the tip of the hook, thus giving greater strength to the gate. On large hoist and crane hooks, the wire rope slings or lifting eyes generally used create side pressure. This new TIP-LOK attachment keeps the gate closed and the load secure. The larger the hook, the greater the leverage against the locking mechanism at the shank.

The device automatically lifts open and drops closed upon contact with the tip of the hook. The locking tip of the gate is available with or without a ring. The ring, of course, makes it possible for remote operation when the hook is used over intense heat or chemicals. The gate may be opened with a reach rod.

The gate and locking mechanism are made of cast brass and the return springs of stainless steel. (216)



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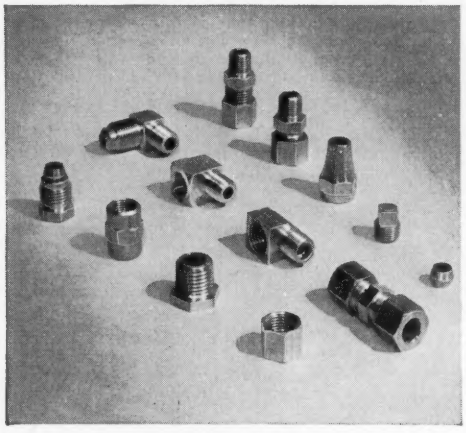
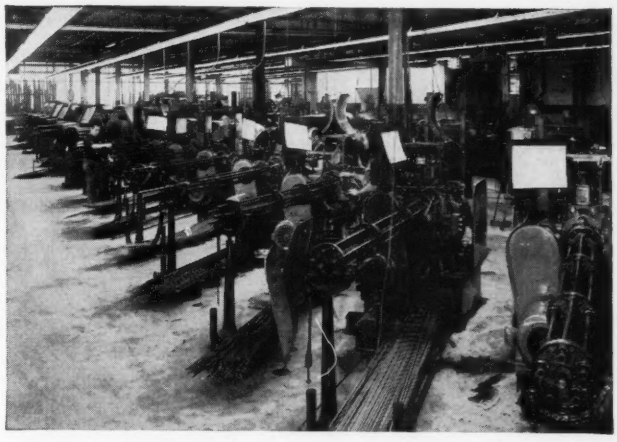


These parts are typical of the wide range of screw machine products made by Weatherhead.



A general view of Weatherhead's high-speed screw machine department.

How to Make Millions of Screw Machine Parts and Make Sure of Their Quality

The Weatherhead Company of Canada, Ltd., St. Thomas, Ontario, achieves both large-scale screw machine production and outstanding parts quality—with Noranda Brass Rod. The variety of parts manufactured by Weatherhead runs into the thousands: automotive fittings, hose assemblies and hose ends, tube fittings and hydraulic system components are but a few of the categories filled by this company with hundreds of different parts of many different metals.

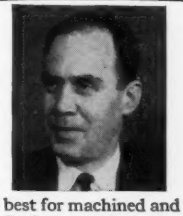
Shown above are automotive fittings made from Noranda Brass Rod, including adapters, inverters and reducers. Because of the vast application of these parts, their production must flow literally without letup . . . and each of the many thousands produced must have unimpaired quality. Both these purposes are met fully by Noranda's high-quality free-machining brass rod.

This free-cutting alloy is used as the standard of machinability in the metals industry, filling 90% of industry's needs for machining rod. It has uniform composition, produces fine chips which do not foul the work or the machine, and minimizes tool wear. In many cases, spindle speeds can be doubled, thus doubling production output with a corresponding reduction in production costs at no sacrifice in precision and quality.

Noranda Brass Rod is made in a range of alloys, shapes, sizes and characteristics to meet your product and production needs. And Noranda's Technical Service is always available in the form of your Noranda representative to help you in achieving the same aims as Weatherhead—quality in volume at costs that will suit you fully. Call on him, his purpose is to serve you.

Specify Duronze when you need a Tough, Durable Alloy

by PHIL CARTER, Technical Service Department



Duronze is one of the more versatile of the bronzes, combining the strong corrosion-resistant properties of copper with many of the mechanical properties of mild steel. It is available in several alloy compositions, the most popular of which are as follows:

	Duronze 609	Duronze 707	Duronze 708
Copper	98.0%	91.0%	92.0%
Silicon	2.0	2.0	1.5
Aluminum	—	7.0	6.5

The Duronze family's high tensile strength and good machining qualities make it a popular alloy for bolts, nuts, gears, valve stems and parts, and marine hardware.

Duronze 707 is best for machined and hot-forged parts. It does not, however, lend itself to cold-forming operations.

Duronze 708, while retaining the fine properties of 707, has sufficient ductility to permit light cold-working along the lines of cold-forming and swaging impossible with 707.

Duronze 609 offers, on the other hand, excellent cold-working properties in addition to excellent corrosion resistance.

Full details on any Duronze alloy are available from your nearest Noranda Sales Office.

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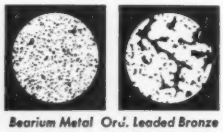
Words cannot describe the advantages and the superiority which BEARIUM METAL offers over all other types of bearing materials. Only when you use it under the most difficult operating conditions can you appreciate its amazing superiority.

So, if you have a bearing application which involves high speeds, poor lubrication, excessive loads, elevated temperatures, dusty and gritty surroundings—or where a liquid other than oil must be used as a lubricant ... BEARIUM METAL will prove to be your best investment.

THE SECRET OF BEARIUM METAL'S superiority is due to the uniform distribution of microscopic lead particles within the copper-tin grains rather than between the grain boundaries—as illustrated by these two photomicrographs.



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Keeping informed

New booklets and technical data for you to read

Nuclear instrumentation — Radiation Counter Laboratories has prepared a manual which explains the uses of nuclear instrumentation in medicine, industry, research and with reactors.

Laminated plastic—G-5—new bulletin has been published by Taylor Fibre Co. describing characteristics of this material.

Flexible couplings—general information, uses and list prices of four types of couplings, are contained in booklet prepared by Acme Chain Corp.

Copper clad phenolite—is title of new pamphlet about printed circuits from copper clad phenolite. National Vulcanized Fibre Co. are publishers.

Flex-o-Drill Specifications—specifications and illustrations are available in catalogue form of the new Strippit Drilling-Layout Machine.

Hysol Compounds—a bulletin on how to select this has been printed. It is called Hysol "Systems Selector" for Electrical Casting Compounds.

Pyrometers—General Electric Co. explain their complete pyrometer line in an eight-page booklet — Pyrometers Bulletin GEA-6650.

Automatic reset thermostats—full details on this extended range put out by Metals and Controls Corporation, "Klixon Disc Type Thermostats."

Silicone and neoprene elements—catalogue No. 103 "Electro-Flex Heating Elements" describes properties, selection and costs. It is published by Electro-Flex.

High voltage testing—Canadian Research Institute has released a treatise on test equipment for use at high voltage. They call it "HighVoltage Testing is a Cinch."

Magnetic clutches and brakes—Magtrol Inc., has written a pamphlet on this subject—"Microclutch Series 59."

Cycloidal blowers for vacuum service—available now is a 14-page booklet by Roots-Connersville Blower: technical diagrams and illustrations.

Tape method of simplified drafting—is the subject matter of a new, fully illustrated booklet just published.

Tantalum Slug Capacitors—Bulletin 159 just issued by Ohmite Manufacturing Co. shows the uses of their Series TS capacitors.

Hermetically sealed terminals—Advance Vacuum Co.'s booklet on Alumina Ceramic-to-Metal Terminals is now available.

Engineering guide to silicone fluids for mechanical applications—has just been published as a design service by Dow Corning.

Time switches—12-page booklet describes full range of time switches by General Electric.

Liquid level gauges and valves—an illustrated eight-page brochure dealing with standard and special function gauges and valves.

Wet blasting and barrel finishing—equipment and applications of this type of precision finishing are described in new bulletin Wheelabrator Liquamatte Model 43.

Forged titanium fittings—Harvey Aluminum discuss this type of fitting in their new "Titanium Fittings" booklet.

Standoff insulator—recent release from Glastic Corporation describes new 2⅛-in-high standoff insulator.

Self-adhesive wire markers—"Perma-Code Wire Marker Bulletin" tells about 4,000 different self-adhesive wire markers by W. H. Brady Co.

Small diameter tubing—Superior Tube Co. have published a "Selection and Application Guide" dealing with this.

Tear-proof drafting film—brochure includes sample of this film too. Ageproof Co. have prepared the publication.

Optimount design reductors and ratiomotors—catalogue put out by Boston Gear describes their full range of specific equipment.

Teflon hoses—"Aeroquip Hose of Teflon" catalogue No. 103 gives a broad selection of medium and high pressure Teflon hoses. Illustrated.

Pressurizing windows—Bomac Laboratories give full details of their line in six-page folder.

Casters and wheels—Rapistan have revised their catalogue which gives full information on conveyors, casters and wheels.

Cold finished steel bars—La Salle Steel Co. have put out a handy wall chart listing all AISI grades of cold finished steel bars.

Aluminum and Fiberglas skylights—the annual catalogue published by The Marco Company is now ready.

Air Conditioners and fans—revised information on American Standard Products air-conditioners and fans.

Valve flanges—many different flanges used on air valves are discussed in bulletin issued by Barber-Coleman Co.

Briefs

We note with interest . . .

. . . South of the border three quarterly reviews are put out by the U. S. Atomic Energy Commission for those who want to keep up with this important industry . . . a gun that saves lives is the new pistol contamination meter which measures beta and gamma radiation from radioactive material . . . "Metal Products from Holland" has a second edition out which seems to give as complete a picture as possible of the Dutch metalworking industry . . . baking enamels requiring color and gloss retention in the 400 deg F range are being made with the use of a new alkyd resin . . . a silicon power rectifier which converts 60-cycle current to direct current has been put into operation at Niagara Falls, N.Y., and to our knowledge it is the world's largest rectifier of this type . . . mice can end it all by drowning these days. A new self-setting aquatic mousetrap works as follows: the rodent is enticed by the smell of food into a box-like trap, it tips a seesaw which drops it into a water-filled tank to drown . . . there are now two American companies reporting production of titanium castings . . . a 1958 edition is available of ASTM Standards for materials such as electro-deposited zinc, cadmium, nickel, chromium, and lead for steel . . . new lines announced recently by various companies: a line of small panel instruments for both a-c and d-c measurements by Canadian GE — a complete line of sonic sifters and filters by Ferro Enamel — a complete range of arc-welding electrodes and accessories by Linde Air Products — full tube production by Wolverine Tubes —new line of high-strength steels by Great Lakes Steel Corp. — a liquid lockwasher which is a polyethylene squeeze capsule containing loctite sealant to fit all sizes and types of threaded fasteners, by American Sealants Co. — stocks of all units of the Miniature Electronic Component Corp. are now offered by the sole Canadian representative, Electromechanical Products . . . a new kind of rubber has recently been discovered which claims to resist oil and maintain strength at temperatures ranging from —100 deg F to 500-plus deg F . . . reports on the successful welding properties of Tens-50 aluminum alloy are available (note our May, p. 58 article describing this new approach to alloying high strength casting).

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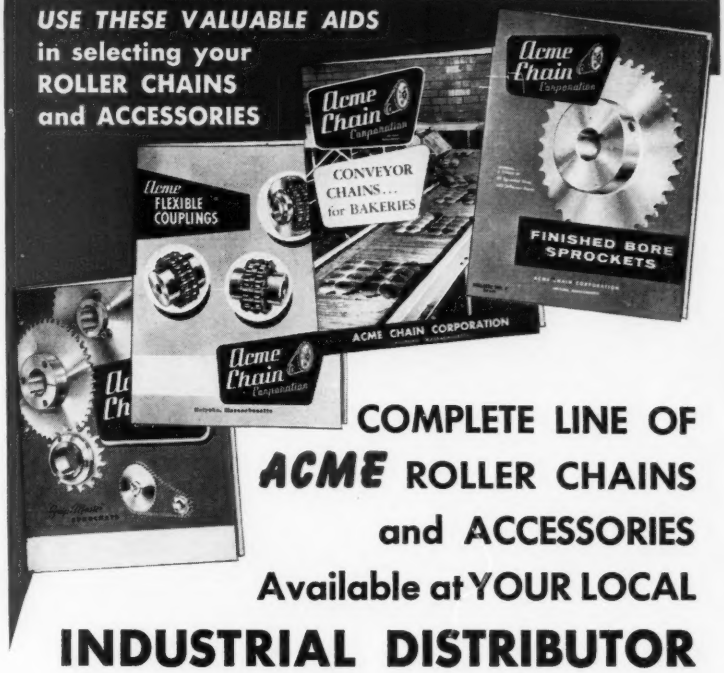

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WHERE ECONOMY, SPEED AND DURABILITY ARE OF PRIME IMPORTANCE

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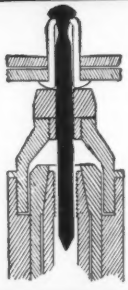
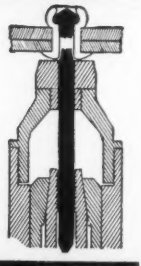
"POP" Rivets are now being used at great savings by makers of truck bodies and trailers . . . railroad cars . . . store display equipment . . . industrial air ducts . . . sheet metal roofing...kitchen cabinets...aircraft...metal furniture, aluminum windows and doors...and other metal fabrication industries. Potential uses of "POP" Rivets are limited only by the ingenuity of design engineers who are offered complete freedom of design. Through a combination of superior fasteners and advanced tooling design, you need no longer compromise your engineering for ease of assembly. Where solutions to fastening problems call for low cost, high strength and durability, call for "POP" Rivets.

Photograph of POP RIVET application

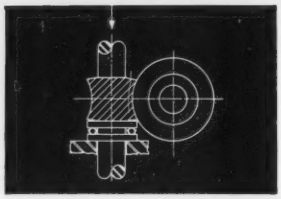


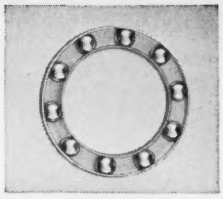
Rivet and Tool in Position Before Setting

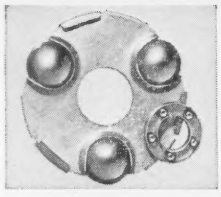


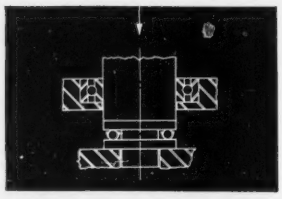
After Setting—Mandrel Head Retained

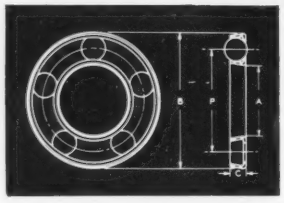
UNITED SHOE MACHINERY COMPANY
of CANADA Limited
MONTREAL TORONTO GALT QUEBEC

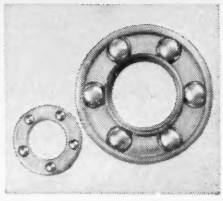












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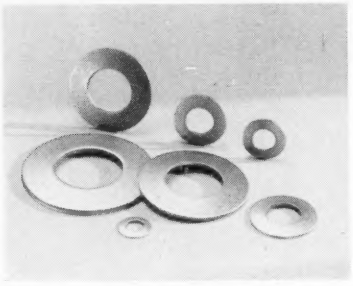
New products & materials

Spring washers

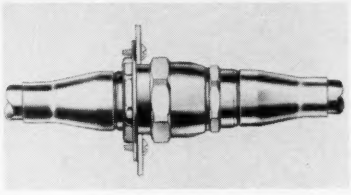
For spring problems involving high loads in limited space, belleville washers in the most used sizes are now available from **Associated Spring Corp.** They are made in two different thicknesses of stock in each of seven diameters ranging from 0.375 to 1,500 in. OD and 0.190 to 0.755 in. ID. Load range for single units covers 30 to 1,200 lb. Residual stresses are introduced during manufacture so the washers can be compressed to the flat



position and released wihout loss of free cone height in spite of the high apparent stress. (217)

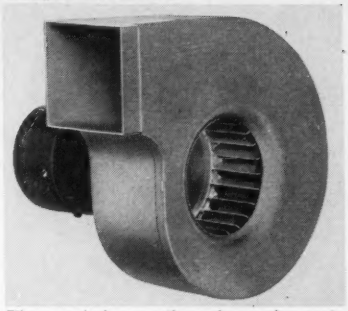
Refrigerant coupling

A self-sealing coupling suitable for use with numerous refrigerants, including F-12 and 22 and similar compounds is put on the market by **Aeroquip Corp.** This coupling is primarily for use on commercial and residential air conditioning and refrigeration units, where evaporator and condenser sections are built separately. It is leakproof when disconnected. The coupling halves seal tight



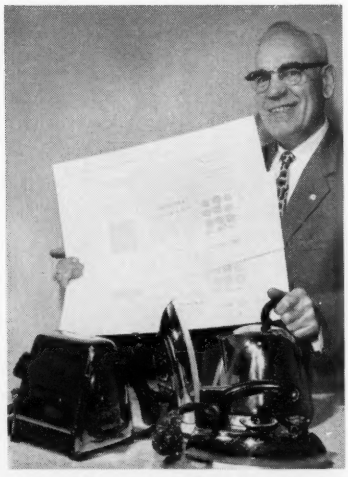
to prevent loss of refrigerant and admission of air or foreign particles in the system. (218)

Low pressure blower



The need for cooling electronic equipment in aircraft, missiles, radio and com-

Continued on page 72



Thomas Penrose of Canadian Westinghouse has added another honour to his list of awards. Design Council of Milan, Italy, lauded his newly designed kettle (described on page 46, 47) and his work on open handle iron—see photograph.

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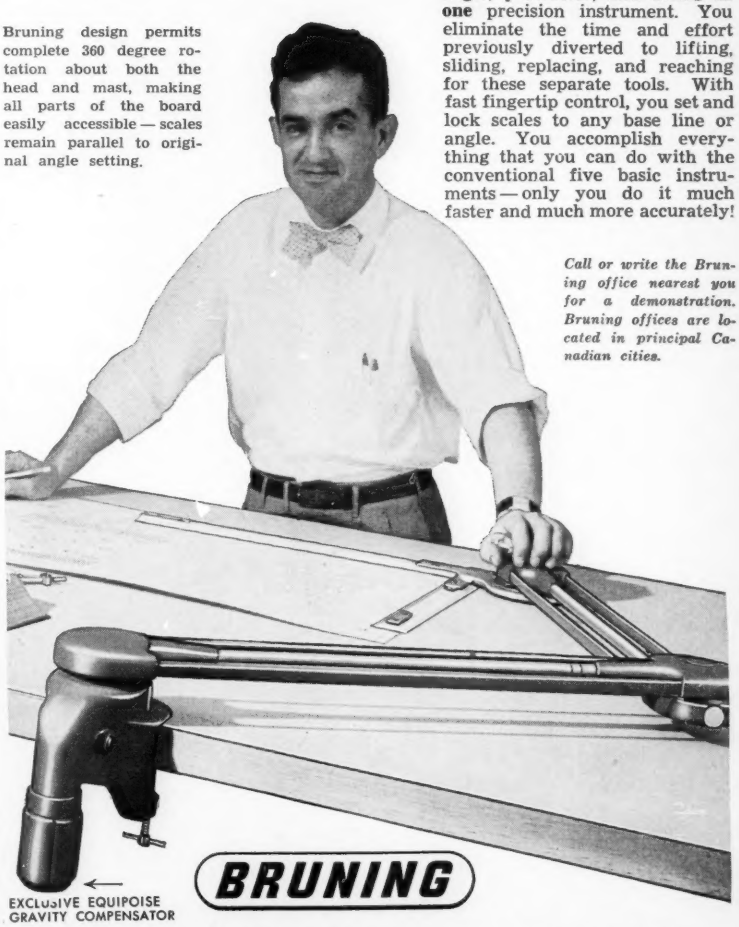
BRUNING DRAFTERS SPEED DRAFTING because they combine T-square, straightedge, triangle, protractor, and scales in **one** precision instrument. You eliminate the time and effort previously diverted to lifting, sliding, replacing, and reaching for these separate tools. With fast fingertip control, you set and lock scales to any base line or angle. You accomplish everything that you can do with the conventional five basic instruments — only you do it much faster and much more accurately!

Bruning design permits complete 360 degree rotation about both the head and mast, making all parts of the board easily accessible — scales remain parallel to original angle setting.

Call or write the Bruning office nearest you for a demonstration. Bruning offices are located in principal Canadian cities.



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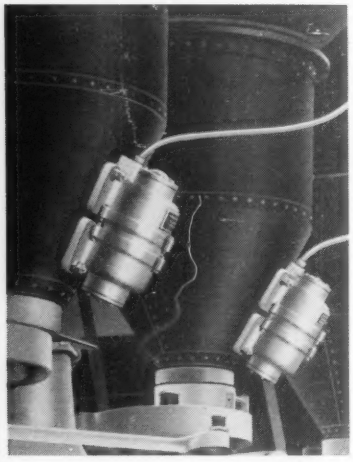
New products
Continued

putors has led to the design of a new low pressure centrifugal blower by **The Torrington Manufacturing Co.** The range of air delivery is from 20 to 2000 cfm, depending upon the impeller size and motor speed. Input power is provided by either ac, dc or 400-cycle aircraft motors.

Airotor blower wheels, with sturdy construction and designed for quiet operation, are used throughout the 2 in. to 9 in. diameter series. Total weight of the unit is less than 2 lb. (219)

Electric vibrator

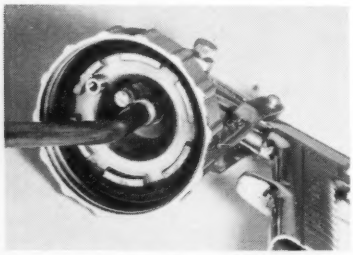
United Steel Corp. has developed a new industrial vibrator for a wide range of industrial applications such as vibrating



bins, screens, tables and hoppers. This vibrator assures a steady even flow of dry or plastic materials both on packing machines to compact loose materials. (220)

Spray gun

A light, sturdy paint spray gun is being



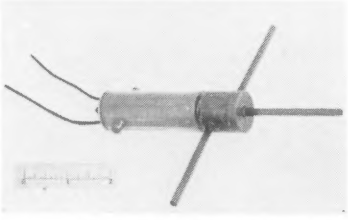
made by **Webster Air Equipment Co.** It will give atomization on as little pressure as 15 to 20 lb yet will handle 60 lb or more air pressure. Its siphon feed with external break-up nozzle assembly and one quart paint cup can be easily changed to pressure feed by changing one screw on the top from one tapped hole to another. (221)

Punched card reader

A punched card reader known as "Speed-reader 2000' has been developed jointly by **Philco Corp.** and **Uptime Corp.** It reads conventional punched cards, row by row, 80 columns wide, at the rate of 2,000 cards per minute. It also has a capacity in the feed and stacking hoppers for 4,000 conventional punched cards. A prototype model has been in full operation for more than six months where engineering evaluation has been completed on the equipment. It proved that high-speed data processing systems can now use punched card data more efficiently with the central computer and off-line equipment. Also, the reading rate can increase the efficiency of conventional tabulating installations and card-to-magnetic tape conversion units (222)

Solenoid valve

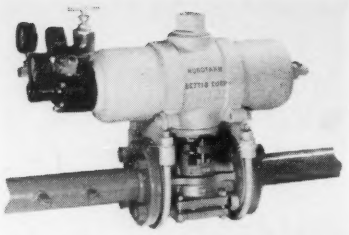
A solenoid valve has been designed by **Alco Valve Co.** upon G.E. Co's request to over-ride the pneumatic controls of a



nuclear reactor being developed for aircraft propulsion. Extreme reliability under high ambient temperatures, small size, light weight, compact design were the requirements. The valve has passed tests in substained temperatures of 500 deg F, as well as military requirements. It is adaptable to all applications requiring resistance to high temperatures and although presently designed as a control for air, it can be adapted to liquids and gases. (223)

Valve actuator

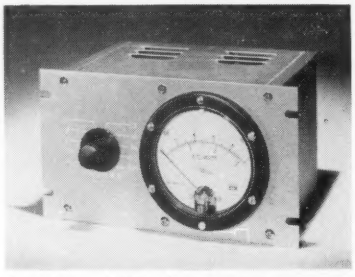
The "robotarm," a new positioning valve actuator introduced by the **Bettis Corp.**, can develop torque capacities up to 4,500 in. lb on 100 lb psi supply air to operate



most standard wrench operated valves. It can convert 3 to 15 psi instrument air into high torque operation for throttling or positioning plug valves, ball valves, and butterfly valves and other 90 deg rotation devices. (224)

Electronic voltmeter

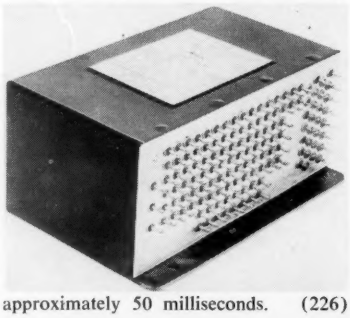
A new militarized ac electronic voltmeter developed by **Metronix, Inc.** will read difficult-to-measure voltages, and is par-



ticularly suitable for measurements at audio and supersonic frequencies. Because its circuitry is completely isolated from the front panel and dust cover, the voltmeter will measure floating or off-ground voltages. It uses a panel 5¼ in. high and 9½ in. wide. Frequency response is from 20 cycles per second to 100 kc and accuracy is plus or minus 2% up to 50 kc, plus or minus 3% thereafter. (225)

Transfer switch

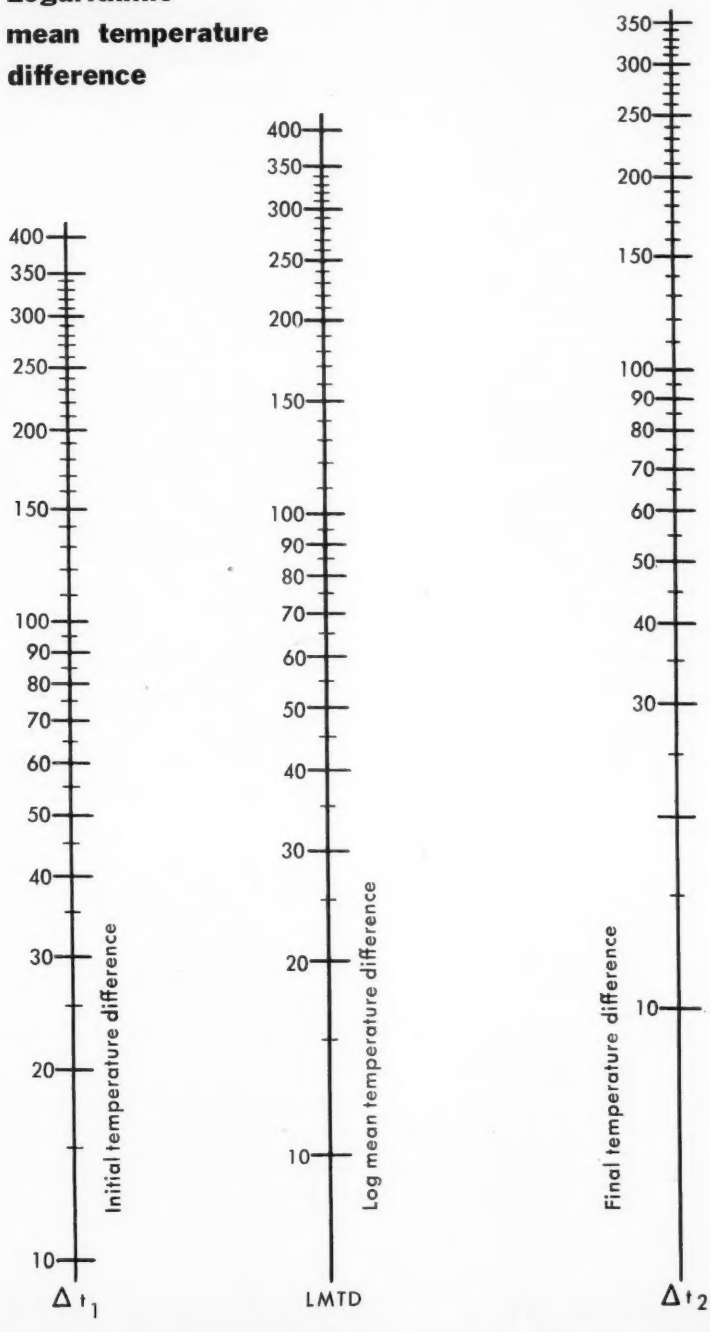
This two-position power transfer switch is used in aircraft and missiles to switch from internal to external power. It can be modified for individual needs. **Airtron** designed it for missile circuit testing, where it functions at the missile's static stage. It is applicable wherever a selection is made between two power sources. Weighing only 3 lb, the unit has 64 SPDT miniature snap-action switches housed in a hermetically sealed container actuated by a rotary solenoid which changes the position of the contacts in



approximately 50 milliseconds. (226)

Design Engineering DATA SHEET

Logarithmic mean temperature difference



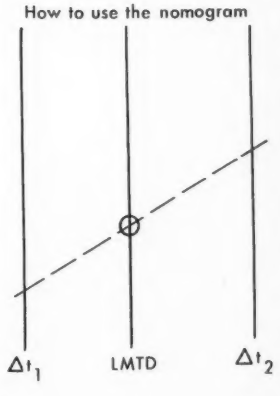
$$LMTD = \frac{\Delta t_1 - \Delta t_2}{2.3 \log_{10} \frac{\Delta t_1}{\Delta t_2}}$$

A formula that takes quite a time to solve is the one given here for finding the Logarithmic Mean Temperature Difference (LMTD).

It is, of course, easier to find the average temperature difference and (even though the result is incorrect) this short cut is often taken. It should, however, never be used in important work.

This chart was therefore developed to make the solution of the formula easy. Connect the initial temperature difference (Δt_1) with the final temperature difference (Δt_2), as shown by the dotted line. The intersection of that line with the middle column gives the value of LMTD.

How to use the nomogram



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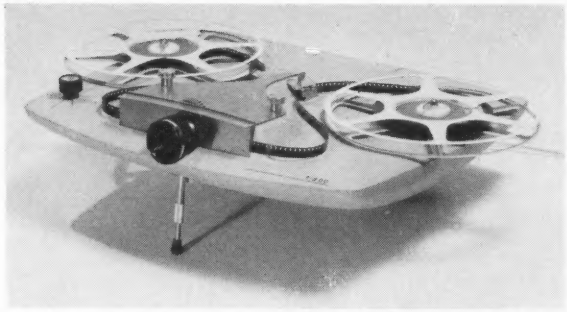
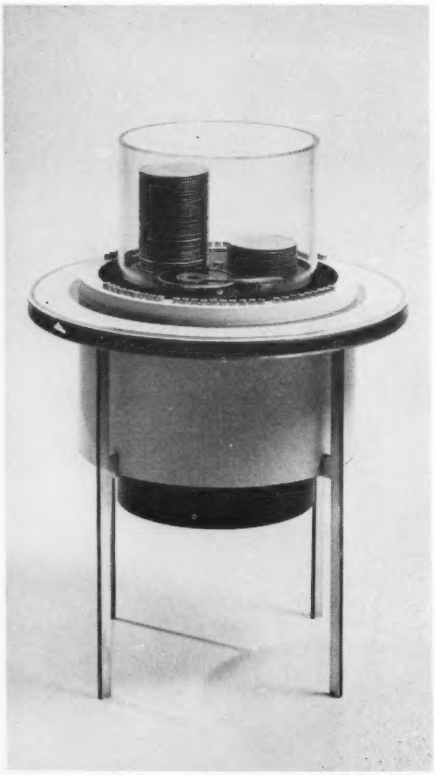
Student designs emphasize the visual

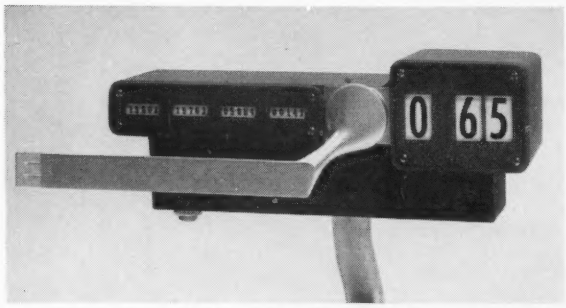
Young designers unite the aesthetic and practical in their work at New York's Pratt Institute



Simple construction of Ernest Califano's movie projector used the film strip itself as part of the design element.



This unconventional jukebox by New Yorker Joseph Roy has circular rim for record selection.



The trim form and clear visibility of this new design for a taxi meter by Walter Erlebacher is a needed improvement.

Stable effect of typewriter's somewhat flattened surface is counteracted by its curved base. Designer: Louis Nelson

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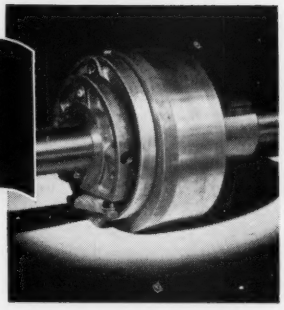
HILLIARD SINGLE REVOLUTION CLUTCH



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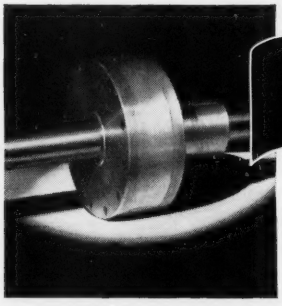

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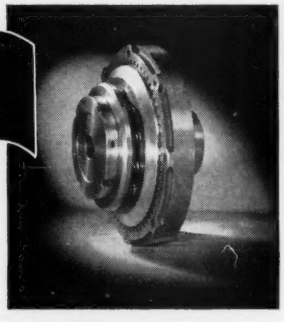

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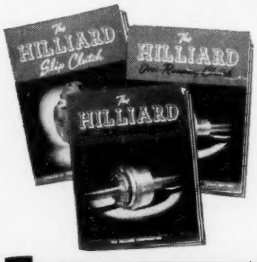

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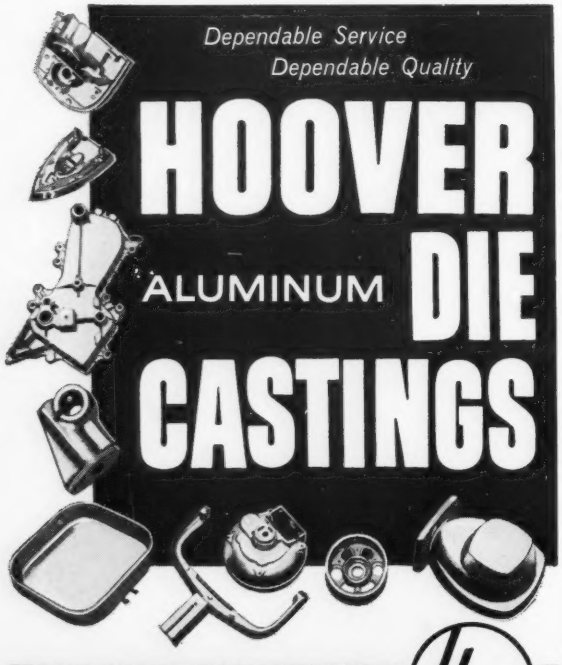

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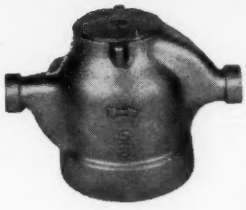

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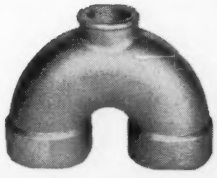

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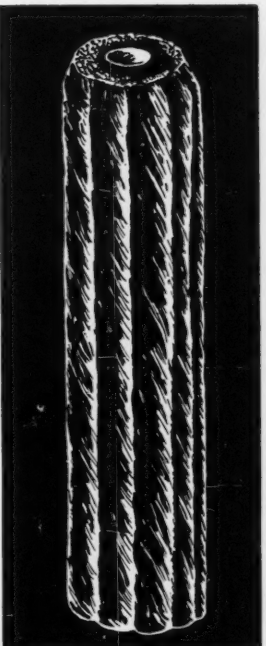

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Editorial

Copper alloys get research boost

You can expect to hear a lot more in the next few months about the BBII, the Brass & Bronze Ingot Institute.

In addition to sponsoring basic research (the results of which will be communicated to design engineers) they plan to be more active at metals and allied conventions, trade shows and engineering society meetings. Their object, of course: to make known the merits of copper-brass alloys.

The Institute is planning to bridge the gap between the foundryman and design engineer, possibly by setting up a group of consultants from industry experienced in both foundry work and design.

These consultants will tell the designer whether it is feasible to cast a part; offer suggestions for a better or cheaper casting; and discuss with the designer the methods, equipment and personnel necessary.

As soon as technical information becomes available, you may be sure that you will read about it in the pages of this magazine.

Aeronautical Engineering Courses

Some confusion has been caused (as is not unusual) by a statement in the press that there is no longer a course in aeronautical engineering at the University of Toronto.

Dr. G. N. Patterson, Director of the Institute of Aerophysics, explained it to me this way. It was realized some years ago that aeronautical engineering is a highly specialized branch (to put it mildly) calling for a wide understanding of the fundamental sciences. There was a time when the design of a new aircraft was essentially an extrapolation (on the back of an envelope, very often) of existing types. Now, a new design involves basic changes and must frequently start from first principles.

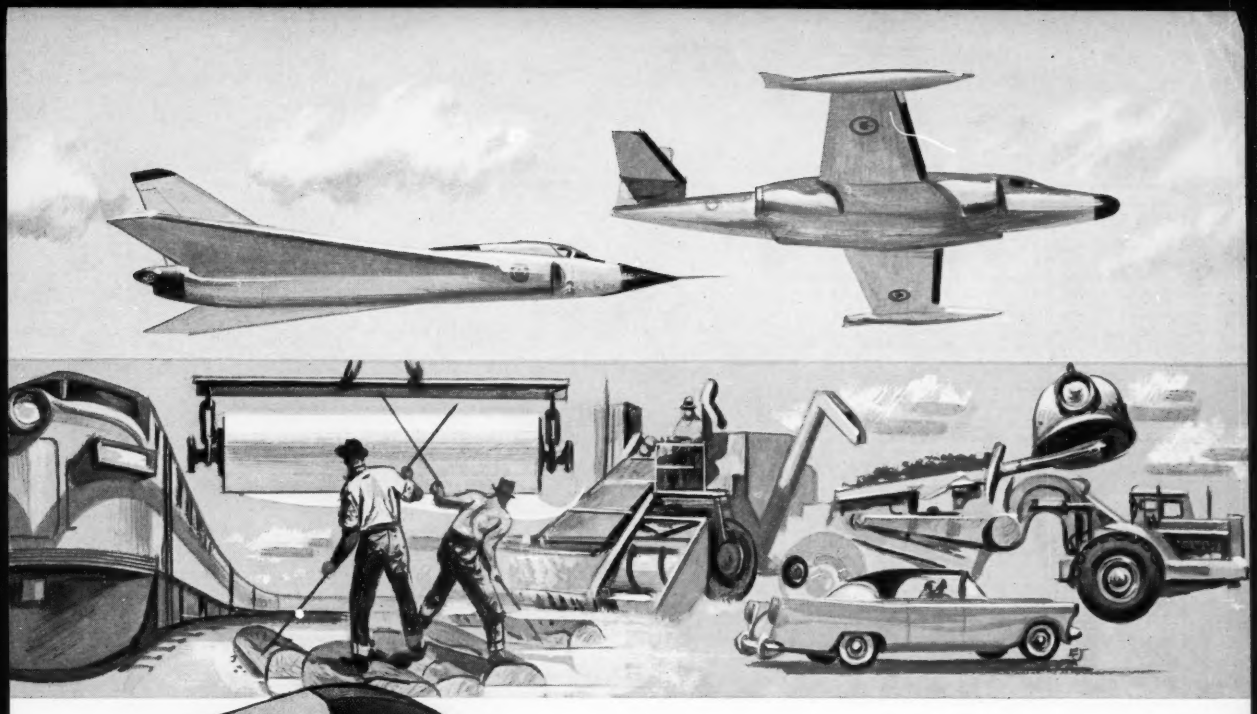
As a result, it was found impossible to confine the University of Toronto course in aeronautical engineering to a period of four years.

Under the present arrangement, a student for a degree in aeronautical engineering registers first in the aeronautical option of the course in engineering physics for four years, and then in the Department of Aeronautical Engineering and Aerophysics for the fifth year. After four years he receives the B.A.Sc. (engineering physics) and after the fifth year the M.A.Sc. (aeronautical engineering).

In short, there has been no interruption of the course in aeronautical engineering, but it has been extended to meet modern requirements.

It is interesting that the framework of the course (although arrived at independently) is identical with that at Cornell University and in all essentials is on a par with the highly regarded courses at Princeton University and the California Institute of Technology.

William Morse.



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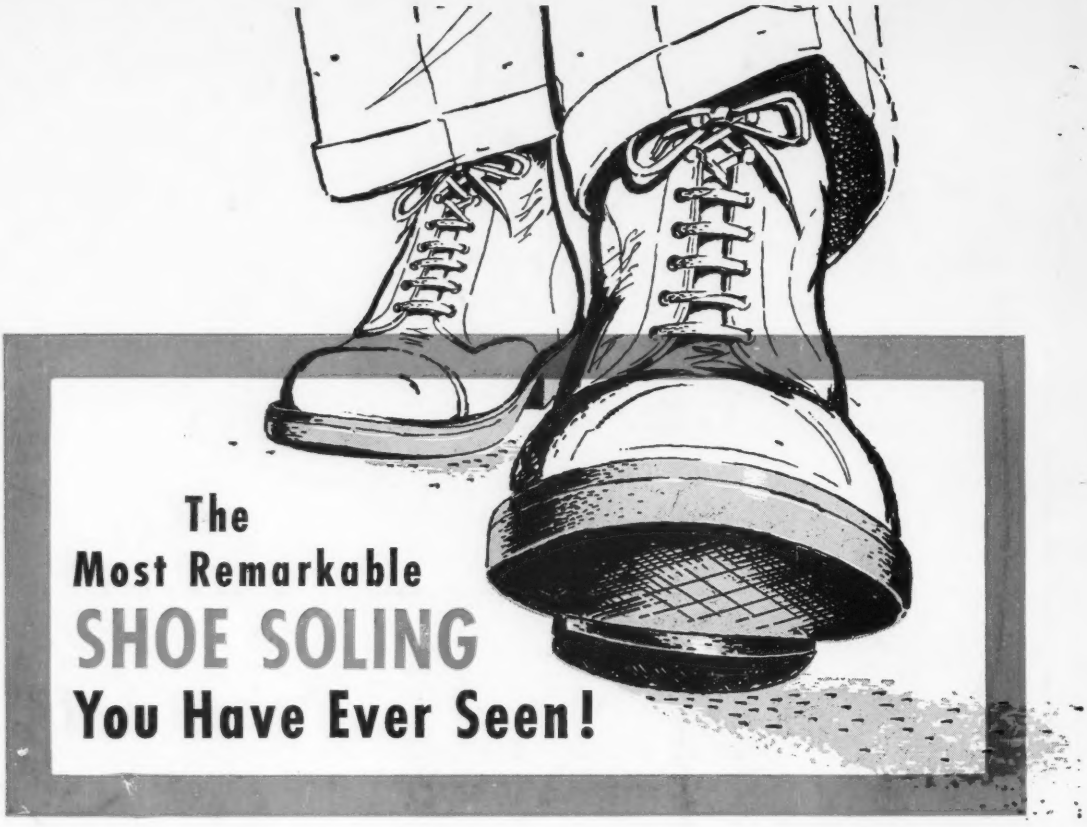

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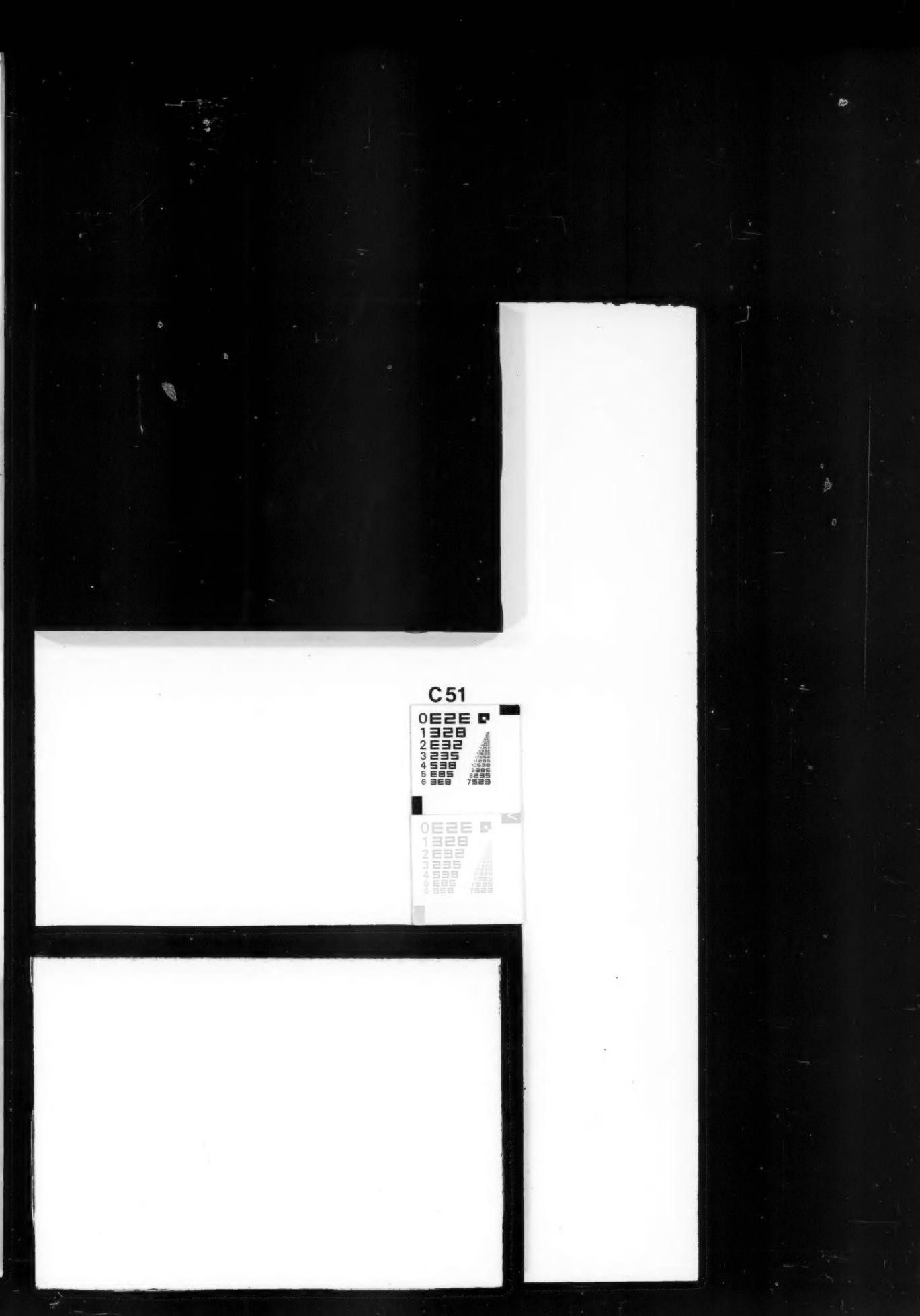
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